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Data Format Control Document for the Earth Observing System (EOS) Flight Operations Segment (FOS) Project Data Base

Volume 1: Generic

Revision A

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Goddard Space Flight Center
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DATA FORMAT CONTROL DOCUMENT
for the
Earth Observing System (EOS) Flight Operations Segment (FOS)
Project Data Base
Volume 1: Generic

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Preface

This document is a formal contract deliverable with an approval code 1. It requires Government review and approval prior to acceptance and use. This document is under ECS contractor configuration control. Once this document is approved, Contractor approved changes are handled in accordance with Class I and Class II change control requirements described in the EOS Configuration Management Plan, and changes to this document shall be made by document change notice (DCN) or by complete revision.

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Abstract

This Data Format Control Document (DFCD) serves as the Interface Control Document (ICD) defining and controlling the format of the Earth Observing System (EOS) Flight Operations Segment (FOS) Project Data Base (PDB). The PDB is used by the FOS in support of mission planning, spacecraft and instrument commanding, and telemetry processing. This document identifies the physical structure, format and content of the PDB definitions.

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Change Information Page

ISSUE	DATE	PAGES AFFECTED	DESCRIPTION
Baseline	08/23/96	All	CCR 505-10-35-001-A
Revision A	04/18/97	All	CCR 505-10-35-002-A

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1. Introduction

1.1 Identification

The Data Format Control Document for the Earth Observing System (EOS) Flight Operations Segment (FOS) Project Data Base (PDB), Contract Data Requirement List (CDRL) item 029, whose requirements are specified in the Data Item Description (DID) 209/SE1, is a required deliverable under the Earth Observing System Data and Information System (EOSDIS) Core System (ECS), Contract (NAS5-60000).

1.2 Scope

This Data Format Control Document (DFCD) is an Interface Control Document (ICD) defining and controlling the format of the EOS FOS project data base (PDB). This information is used by the EOS Operations Center (EOC) in support of mission planning, spacecraft commanding and telemetry processing for the EOS spacecrafts. The physical structure of the information, the format and content of each record.

1.3 Purpose and Objectives

The EOS FOS PDB DFCD defines the telemetry, command, activity and constraint definitions necessary to support mission planning, spacecraft commanding and telemetry processing. These definitions are provided by the spacecraft contractor, the Flight Operations Team (FOT) and the Instrument Operations Team (IOT). The information provided in this document will govern these definitions received by and processed at the EOC.

1.4 Status and Schedule

This version of the DFCD for the EOS FOS PDB is a complete revision to support all baseline capabilities of the FOS. It will be used to support multiple EOS missions. The final version of the DFCD for the EOS AM-1 PDB was delivered two weeks prior to the ECS Critical Design Review (CDR). It was submitted as a Configuration Control Board (CCB) approval Code 1 document. At the Government's option, the final DFCD may be designated to be under full Government CCB control. After approval, changes may be submitted for consideration by Contractor and Government CCBs under the normal change process at any time.

1.5 Document Organization

This document is organized into an introduction, followed by five sections and an appendix. The introduction provides the document identification, scope, purpose and objectives and thestatus and schedule. Section 2 provides a bibliography of reference documents for the DFCD. These documents are organized by parent, applicable, and information subsections. Section 3 presents an overview on the PDB definitions. Section 4 identifies the definitions that make up the PDB and provides a brief description of each. Section 5 defines the content of each PDB record type. Specific information is identified to govern the accuracy of their content. An abbreviations and acronym list is also provided.

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2. Related Documentation

2.1 Parent Documents

The following documents are the parents from which this document's scope and content derive:

304-CD-001-003	Flight Operations Segment (FOS) Requirements Specification for the ECS Project, Volume 1: General Requirements
304-CD-004-003	Flight Operations Segment (FOS) Requirements Specification for the ECS Project, Volume 2: AM-1 Mission Specific
423-41-01	Goddard Space Flight Center, EOSDIS Core System Statement of Work, June 2, 1994
423-41-02	Goddard Space Flight Center, Functional and Performance Requirements Specification for the Earth Observing System Data and Information System (EOSDIS) Core System, June 2, 1994
505-41-15	Goddard Space Flight Center, Interface Requirements Document Between ECS and EOS-AM Project for AM-1 Flight Operations
none	Interproject Agreement Between AM and ESDIS Projects on Flight Operations for the AM-1 Spacecraft (under development)

2.2 Applicable Documents

The following documents are referenced herein and are directly applicable to this document. In the event of conflict between any of these documents and this document, this document shall take precedence.

305-CD-040-001	Overview of the Flight Operations Segment (FOS) Design Specification for the ECS Project
305-CD-041-001	FOS Planning and Scheduling Design Specification for the ECS Project
305-CD-042-001	FOS Command Management Design Specification for the ECS Project
305-CD-043-001	FOS Resource Management Design Specification for the ECS Project
305-CD-044-001	FOS Telemetry Design Specification for the ECS Project
305-CD-045-001	FOS Command Design Specification for the ECS Project
305-CD-046-001	Real-Time Contact Management Design Specification for the ECS Project
305-CD-047-001	Analysis Design Specification for the ECS Project

305-CD-048-001	FOS User Interface Design Specification for the ECS Project
305-CD-049-001	FOS Data Management Design Specification for the ECS Project
305-CD-050-001	FOS Planning and Scheduling Program Design Language for the ECS Project
305-CD-051-001	FOS Command Management Program Design Language for the ECS Project
305-CD-052-001	FOS Resource Management Program Design Language for the ECS Project
305-CD-053-001	FOS Telemetry Program Design Language for the ECS Project
305-CD-054-001	FOS Real-Time Contact Management Program Design Language for the ECS Project
305-CD-055-001	FOS Analysis Program Design Language for the ECS Project
305-CD-056-001	FOS User Interface Program Design Language for the ECS Project
305-CD-057-001	FOS Data Management Program Design Language for the ECS Project
305-CD-058-001	FOS Command Program Design Language for the ECS Project
none	Lockheed Martin Corporation, EOS-AM Ground System Requirements
none	Lockheed Martin Corporation, AM-1 Spacecraft Analysis Software Requirements Document
ICD-106	Lockheed Martin Corporation, Interface Control Document Data Format Control Book for EOS-AM Spacecraft (ICD-106)

3. PDB Overview

3.1 PDB General Constraints

The following constraints and limitations apply to the PDB:

- The number of PDB definitions will be 62.
- Each telemetry parameter may specify up to 4 red/yellow limit sets.
- Each telemetry parameter may specify one delta limit.
- Each telemetry parameter may specify up to 4 calibration curves of one calibration type.
- Each polynomial conversion equation may specify up to 8 coefficients (e.g., 7th order polynomial). At a minimum, each equation must have 2 coefficients.
- Each linear conversion equation may specify up to 16 point pairs (15 line segments)
- Each discrete parameter may specify up to 32 discrete ranges.
- Each derived (pseudo) equation may specify up to 6 input parameters.

3.2 PDB Sizing Assumptions

The following assumptions are being made for the database sizing estimates for the EOS PDB spacecraft:

- The maximum number of telemetry definitions will not exceed 8000.
- The maximum number of command definitions will not exceed 4000.
- The maximum number of activity definitions will not exceed 5000.
- The maximum number of constraint definitions will not exceed 2500.

3.3 PDB Input

The Project Data Base (PDB) consists of information provided by the S/C contractor, the FOT and the IOT. Initially, a subset of the PDB will be provided as definition files from the S/C contractor. This information is derived from the I&T database. The FOT and IOTs, using database edit tools provided by the FOS, will define the activity and constraint PDB and any additional information needed to support telemetry and command processing.

The method of transfer for any definition files from the S/C contractor will be KFTP. Each new release of information from the I&T will be sent to a dedicated directory at the EOC. Additionally, the DBA will be notified of the transfer.

PDB information not provided by the S/C contractor will be defined at the EOC by the FOT. Command-level constraint definitions will be added to the PDB using a database edit tool. Activity-level Constraint definitions will be generated using the Constraint Definer Tool (CDT) and activity definitions will be generated using the Activity Definer Tool (ADT).

The Instrument Operations Team (IOT) will be provided with the capability to update the PDB for their instrument-specific definitions using a database edit tool. This function will be provided through a web browser.

3.4 PDB Generation Scenario

The PDB generation process is performed in a non-real-time, interactive environment. This process is made up of the following steps:

- The PDB generation process begins with PDB files derived from the latest version of the I&T database. The PDB files, containing the telemetry and command definitions, will be sent to a dedicated area at the EOC. These definition files will be loaded into the telemetry and command PDB database tables within the FOS. Each new release of the PDB files from I&T will replace the existing release.
- Activity-level constraint definitions are provided by the FOT and IOTs through the use of the Constraint Definer Tool.
- Activity definitions are provided by the FOT and IOTs through the use of the Activity Definer Tool. Activity definitions will be appended to the activity PDB as needed.
- A database edit function will allow adding, deleting and modification of the contents of the definitions files once loaded into the PDB structures at the EOC. Information not provided by the S/C contractor through their I&T database but required for EOC operations can be added by the FOT using this function. Command-level constraint definitions can be added using this tool. Additionally, definitions can be updated; and invalid data can be deleted.
- The IOT can provide changes to the PDB through the use of a database edit tool. Once updates have been made, the IOT must notify the DBA through E-mail. The DBA will be responsible for loading these changes into the PDB after being approved.
- Once corrections and changes have been made to the data definitions, the DBA may invoke validation of the PDB. Validation includes syntax checking, verification of values and cross-checking of related definition files. This step will ensure the accuracy of the definitions used for operations. The generation of a validation report will provide the DBA with the results of the validation. The process of editing and validating the PDB may be repeated until the validated PDB is acceptable for operational use.
- Three methods for validation of the PDB will exist at the EOC. The first method provides for validation of the entire PDB, i.e., validation of the telemetry, command, constraint and activity definitions. This process reflects a specific order which is required to support the integrity of the definitions. The second method provides for validation of the definitions. Revalidation of the command PDB requires revalidation of both constraints and activities.

The third method provides for validation of the activity definitions. Updates to the constraint and activity PDB may occur independent of a new release of the I&T database. For this reason, the PDB generation process provides validation of the constraint and activity PDB, independent of the telemetry and command as in the validation process, for the validated constraint PDB, or for only the validated activity PDB. During this process definitions requiring conversion will be reformatted to support the users need. A version number will be generated reflecting the validated PDB being used, i.e., version 2.1.2 would indicate the second release of the I&T database, with the first version of validated constraints associated with that release and the second version of validated activities associated with that release.

- As part of the operational data generation process, the new version of PDB definitions used for operations will be dumped from the database and distributed.
- Authorized users of the data base may select to view information maintained in the operational PDB via the IST. The user may access information by PDB file type or by a unique value such as mnemonic. This information may be viewed on a display or can be provided in hard copy form as files.

3.5 PDB Distribution

The operational PDB will be made available in file format to external FOS users. The format of each definition will be governed by the rules that appear in Section 4.3. The distribution list for the operational PDB includes the Program Maintenance Library (PML).

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4. PDB Specifications

4.1 PDB Structure

The Project Data Base (PDB) consists of definitions from the I&T database and the FOT. Table 4-1 contains a list of the required definitions. These definitions may be provided through the use of database edit tools or through a file.

The data delivered as a PDB file must be in American Standard Code for Information Interchange (ASCII) text format. Each PDB file must conform to their associated record format described in Section 5.

4.2 PDB Descriptions

This section provides an overview of the telemetry; command; activity; and constraint definitions contained in the PDB. The spacecraft contractor, the FOT and the IOT will collectively provide the definitions that make up the PDB. The FOS operational data generation process will use the PDB, once validated, as input.

4.2.1 Telemetry Definitions

4.2.1.1 Telemetry Packet Specification PDB

The Telemetry Packet Specification PDB identifies the CCSDS packets used to transmit telemetry parameters for the EOS spacecraft. Section 5.1.1 provides the record format.

4.2.1.2 Telemetry Parameter Specification PDB

The Telemetry Parameter Specification PDB defines both analog and discrete telemetry parameters used by the EOS spacecraft. This file provides the location of each telemetry parameter and is used to build the telemetry decommutation mapping tables. Section 5.1.2 provides the record format.

4.2.1.3 Telemetry Description PDB

The Telemetry Description PDB provides descriptive information about each telemetry parameter. It contains analog, discrete and derived parameter definitions. Section 5.1.3 provides the record format.

4.2.1.4 Telemetry EU Conversion Specification PDB

The Telemetry EU Conversion Specification PDB provides a list of telemetry parameters with EU conversion information defined. Section 5.1.4 provides the record format.

Table 4-1. List of PDB Definitions (1 of 2)

Filename		Description
tlm_packet_ pdb		Telemetry Packet Specification PDB
tlm_parm_ pdb		Telemetry Parameter Specification PDB
tlm_desc_ pdb		Telemetry Description PDB
tlm_calcurve_ pdb		Telemetry EU Conversion Specification PDB
tlm_polyconv_xxx.pdb		Polynomial Coefficients Specification PDB
tlm_lineconv_pdb		Linear Coefficients Specification PDB
tlm_rylim_xxx.pdb		Red/Yellow Limit Specification PDB
tlm_limsel_xxx.pdb		Limit Selection Specification PDB
tlm_delta_xxx.pdb		Delta Limit Specification PDB
tlm_dstate_xxx.pdb		Discrete State Specification PDB
tlm_context_xxx.pdb		Context Dependent Specification PDB
tlm_derived_xxx.pdb		Derived Telemetry Specification PDB
tlm_constant_xxx.pdb		Telemetry Constant Specification PDB
tlm_lgdesc_xxx.pdb		Telemetry Long Description PDB
cmd_parm_xxx.pdb		Command Parameter Specification PDB
cmd_desc_xxx.pdb		Command Description PDB
cmd_fixdata_xxx.pdb		Command Fixed Data Word Specification PDB
cmd_vardata_xxx.pdb		Command Variable Data Word Specification PDB
cmd_verify_xxx.pdb		Command Execution Verification (CEV) PDB
cmd_pstate_xxx.pdb		Prerequisite State Specification PDB
cmd_lgdesc_xxx.pdb		Command Long Description PDB
cmd_tbldef_xxx.pdb		Table Definition PDB
cmd_flddef_xxx.pdb		Table Field Definition PDB
cmd_mmask_xxx.pdb		Memory Masking Definition PDB
cmd_maskgrp_xxx.pdb		Memory Masking Group Definition PDB
act_def_xxx.pdb		Activity Definition PDB
act_dirdef_xxx.pdb		Activity Directive Definition PDB
act_ecldir_xxx.pdb		Activity Complex ECL Directive Definition PDB
act_eclcmd_xxx.pdb		Activity ECL Command Procedure Definition PDB
act_eclcom_xxx.pdb		Activity ECL Comment Directive Definition PDB
act_cmddef_xxx.pdb		Activity Command Definition PDB
act_cmdsubfld_xxx.pdb		Activity Command Subfield Definition PDB
act_dfltsubfld_xxx.pdb		Activity Default Command Subfield Definition PDB
act_intsubfld_xxx.pdb		Activity Integer Subfield Definition PDB
act_fltsubfld_xxx.pdb		Activity Float Subfield Definition PDB
act_dscsubfld_xxx.pdb		Activity Discrete Subfield Definition PDB
act_dscsubvv_xxx.pdb		Activity Discrete Subfield Valid Values Definition PDB
act_funcsub_xxx.pdb		Activity Function Subfield Definition PDB
act_cmdproc_xxx.pdb		Activity Command Procedure Definition PDB
act_cmplxact_xxx.pdb		Complex Activity Child Reference PDB
act_modetran_xxx.pdb		Activity Mode Transition Definition PDB
act_mode_xxx.pdb		Activity Mode Definition PDB
act_resdef_xxx.pdb		Activity Resource Definition PDB

Note: xxx represent the version number (000-999) associated with the PDB.

Table 4-1. List of PDB Definitions (2 of 2)

Filename		Description
act_rescmd_xxx.pdb		Activity Resource Command Definition PDB
act_respwr_xxx.pdb		Activity Resource Power Definition PDB
act_resbuff_xxx.pdb		Activity Resource Buffer Definition PDB
act_reshier_xxx.pdb		Activity Resource Hierarchy Definition PDB
act_schedhier_xxx.pdb		Activity Scheduling Resource Hierarchy Definition PDB
act_schedres_xxx.pdb		Activity Scheduling Resource Definition PDB
con_bitrule_xxx.pdb		Bit Rule Definition PDB
con_comrule_xxx.pdb		Comment Rule Definition PDB
con_noexistrule_xxx.pdb		No Exist Rule Definition PDB
con_offsetrule_xxx.pdb		Offset Rule Definition PDB
con_prerule_xxx.pdb		Prerule Definition PDB
con_postrule_xxx.pdb		Postrule Definition PDB
con_satisfier_xxx.pdb		Satisfier Constraint Definition PDB
con_scalarrule_xxx.pdb		Scalar Rule Definition PDB
con_subfld_xxx.pdb		Subfield Constraint Definition PDB
con_subfldbit_xxx.pdb		Subfield Bit Constraint Definition PDB
con_opmode_xxx.pdb		Operational Mode Specification PDB
con_opmodetran_xxx.pdb		Operational Mode Transition Specification PDB
con_event_xxx.pdb		Event Specification PDB
con_activity_xxx.pdb		Activity Constraint Specification PDB
con_consume_xxx.pdb		Consumable Constraint Specification PDB

Note: xxx represent the version number (000-999) associated with a PDB input file.

4.2.1.5 Polynomial Coefficients Specification PDB

The Polynomial Coefficients Specification PDB defines the engineering unit (EU) conversion criteria using a polynomial equation up to the 7th order for the specified telemetry parameters. Section 5.1.5 provides the record format.

4.2.1.6 Linear Coefficient Specification PDB

The Linear Coefficient Specification PDB defines the EU conversion criteria using a linear equation. Section 5.1.6 provides the record format.

4.2.1.7 Red/Yellow Limit Specification PDB

The Red/Yellow Limit Specification PDB defines telemetry parameters that are limit checked using a red/yellow - high/low criteria. Each telemetry parameter may specify up to 4 different limit sets. Section 5.1.7 provides the record format.

4.2.1.8 Limit Selection Specification PDB

The Limit Set Specification PDB defines the criteria for selection of a limit set for those telemetry parameters having limits sets defined. Section 5.1.8 provides the record format.

4.2.1.9 Delta Limit Specification PDB

The Delta Limit Specification PDB defines telemetry parameters that are limit checked using a delta limit criterion. Delta limit checking refers to checking a parameter based on the change in value of successive samples. Each telemetry parameter may specify one delta limit. Section 5.1.9 provides the record format.

4.2.1.10 Discrete State Specification PDB

The Discrete State Specification PDB associates ASCII text with a range of values for discrete telemetry parameters. Each discrete parameter may specify up to 32 ranges. Section 5.1.10 provides the record format.

4.2.1.11 Context Dependent Specification PDB

The Context Dependent Specification PDB defines a condition under which a telemetry parameter is decommutated. A discrete telemetry context switch parameter is used to indicate the condition that must exist for decommutation of the particular parameter. Sixteen distinct ranges may be specified with no undefined states. Section 5.1.11 provides the record format.

4.2.1.12 Derived Telemetry Specification PDB

The Derived Telemetry Specification PDB defines special algorithms that are derived from the values of analog parameters, discrete parameter, constant parameters and previously defined derived telemetry parameters. Section 5.1.12 provides the record format.

4.2.1.13 Telemetry Constant Specification PDB

The Telemetry Constant Specification PDB assigns mnemonics to constant values. Constants are used as input to equations. Section 5.1.13 provides the record format.

4.2.1.14 Telemetry Long Description PDB

The Telemetry Long Description PDB provides the detailed description of a telemetry parameter. Section 5.1.14 provides the record format.

4.2.2 Command Files

4.2.2.1 Command Parameter Specification PDB

The Command Parameter Specification PDB defines parameters used in support of spacecraft and instrument commanding for the EOS spacecraft. This file contains information necessary to construct commands. Additionally, this file provides characteristics of the command such as safety level. Section 5.2.1 provides the record format.

4.2.2.2 Command Description PDB

The Command Description Specification PDB provides descriptive information about each spacecraft and instrument command. Section 5.2.2 provides the record format.

4.2.2.3 Command Fixed Data Word Specification PDB

The Command Fixed Data Word Specification PDB defines the fixed data words associated with a command. Each command may specify up to 33 16-bit words including the command destination and command descriptor. Section 5.2.3 provides the record format.

4.2.2.4 Command Variable Data Word Specification PDB

The Command Variable Data Word Specification PDB defines commands that require parameter input by the user. These commands may contain both fixed and variable data words. Each command of variable type may reference up to 10 subfield names. Each subfield may define up to 10 states. Section 5.2.4 provides the record format.

4.2.2.5 Command Execution Verification (CEV) PDB

The Command Execution Verification PDB defines telemetry parameters that support verification of command execution and reception. Each command may specify one discrete telemetry parameter as a verifier. Section 5.2.5 provides the record format.

4.2.2.6 Prerequisite State Specification PDB

The Prerequisite State Specification PDB provides the transmission criteria for commands. Each command requiring prerequisite state checking may specify up to 4 discrete telemetry parameters. Transmission of a command can only occur when all telemetry parameters specified for the command occur within their defined range. Section 5.2.6 provides the record format.

4.2.2.7 Command Long Description PDB

The Command Long Description PDB provides the detailed description of a command parameter. Section 5.2.7 provides the record format.

4.2.2.8 Table Definition PDB

The Table Definition PDB defines areas of memory on board the spacecraft. These areas of spacecraft or instrument memory, referred to as tables, will store parameters and supply commands to the onboard computer or instruments. Table loads provide updates to these tables from the ground. Section 5.2.8 provides the record format.

4.2.2.9 Table Field Definition PDB

The Table Field Definition PDB defines fields within a spacecraft or instrument table. This file will contain information that supports the capability to build the content of a table load. Section 5.2.9 provides the record format.

4.2.2.11 Memory Masking Group Definition PDB

The Memory Masking Group Definition PDB defines areas of memory that are part of the same group. Section 5.2.11 provides the record format.

4.2.2.10 Memory Masking Definition PDB

The Memory Masking Definition PDB defines the areas of memory that are masked when performing dump and ground memory image comparisons. Section 5.2.10 provides the record format.

4.2.3 Activity Files

4.2.3.1 Activity Definition PDB

The Activity Definition PDB defines the attributes of a generic activity. These activities represent user requests to change the mode/configuration of an instrument or a spacecraft subsystem. Section 5.3.1 provides the record format.

4.2.3.2 Activity Directive Definition PDB

The Activity Directive Definition PDB provides attributes for a directive that exists in an activity. Section 5.3.2 provides the attributes that exist in an activity. Section 5.3.2 provides the record format.

4.2.3.3 Activity Complex ECL Directive Definition PDB

The Activity Complex ECL Directive Definition PDB provides the attributes for a complex ECL directive that exists in an activity. Section 5.3.3 provides the record format.

4.2.3.4 Activity ECL Command Procedure Definition PDB

The Activity ECL Command Procedure Definition PDB provides the attributes for an ECL command procedure directive that exists in an activity. Section 5.3.4 provides the record format.

4.2.3.5 Activity ECL Comment Directive Definition PDB

The Activity Command Definition PDB provides the attributes for an ECL comment directive that exists in an activity. Section 5.3.5 provides the record format.

4.2.3.6 Activity Command Definition PDB

The Activity Command Definition PDB provides the attributes of a command that exists within an activity. Section 5.3.6 provides the record format.

4.2.3.7 Activity Command Subfield Definition PDB

The Activity Command Subfield Definition PDB associates subfields with their commands in an activity. Section 5.3.7 provides the record format.

4.2.3.8 Activity Default Command Subfield Definition PDB

The Activity Default Command Subfield Definition PDB provides additional details for a command subfield. Section 5.3.8 provides the record format.

4.2.3.9 Activity Integer Subfield Definition PDB

The Activity Integer Subfield Definition PDB defines integer subfield values. Section 5.3.9 provides the record format.

4.2.3.10 Activity Float Subfield Definition PDB

The Activity Float Subfield Definition PDB defines float subfield values. Section 5.3.10 provides the record format.

4.2.3.11 Activity Discrete Subfield Definition PDB

The Activity Discrete Subfield Definition PDB defines discrete subfield values. Section 5.3.11 provides the record format.

4.2.3.12 Activity Discrete Subfield Valid Values Definition PDB

The Activity Discrete Subfield Valid Values Definition PDB defines discrete subfield valid values. Section 5.3.12 provides the record format.

4.2.3.13 Activity Function Subfield Definition PDB

The Activity Function Subfield Definition Record is used to keep a function name subfield value. Section 5.3.13 provides the record format.

4.2.3.14 Activity Command Procedure Definition PDB

The Activity Command Procedure Definition PDB defines those command procedures associated with a command within an activity. Section 5.3.14 provides the record format.

4.2.3.15 Complex Activity Child Resource PDB

The Complex Activity Child Resource PDB provides information on scheduling an activity within another activity. Section 5.3.15 provides the record format.

4.2.3.16 Activity Mode Transition Definition PDB

The Activity Mode Transition Definition PDB defines the valid mode transitions that an activity can go through. Section 5.3.16 provides the record format.

4.2.3.17 Activity Mode Definition PDB

The Activity Mode Definition PDB provides information on the power, data rate, resource that the mode can be scheduled on. Section 5.3.17 provides the record format.

4.2.3.18 Activity Resource Definition PDB

The Activity Resource Definition PDB provides information on resources for planning and scheduling. Section 5.3.18 provides the record format.

4.2.3.19 Activity Resource Command Definition PDB

The Activity Resource Command Definition PDB provides information on resource commands for planning and scheduling. Section 5.3.19 provides the record format.

4.2.3.20 Activity Resource Power Definition PDB

The Activity Resource Power Definition PDB provides information on resource power consumption for planning and scheduling. Section 5.3.20 provides the record format.

4.2.3.21 Activity Resource Buffer Definition PDB

The Activity Resource Buffer Definition PDB provides information on resource data volume for planning and scheduling. Section 5.3.21 provides the record format.

4.2.3.22 Activity Resource Hierarchy Definition PDB

The Activity Resource Hierarchy Definition PDB provides a resource parent-child relationship. Section 5.3.22 provides the record format.

4.2.3.23 Activity Scheduling Resource Hierarchy Definition PDB

The Activity Scheduling Resource Hierarchy Definition PDB provides a scheduling resource parent-child relationship. Section 5.3.23 provides the record format.

4.2.3.24 Activity Scheduling Resource Definition PDB

The Activity Scheduling Resource Definition PDB provides information on scheduling resource for planning and scheduling. Section 5.3.24 provides the record format.

4.2.4 Constraint Files

4.2.4.1 Command Constraint Files

4.2.4.1.1 Bit Rule Definition PDB

The Bit Rule Definition PDB provides the constraint criteria to ensure the value of the trigger command's subfield bits satisfy the condition of equal to or not equal to the specified bit value. Section 5.4.1.1 provides the record format.

4.2.4.1.2 Comment Rule Definition PDB

The Comment Rule Definition PDB associates command parameters, referred to as the trigger command, with a warning message. When the trigger command is encountered the defined message is output to the user. The rule definition may specify subfield and/or subfield bit criteria for the trigger command. Section 5.4.1.2 provides the record format.

4.2.4.1.3 No Exist Rule Definition PDB

The No Exist Rule Definition PDB provides the constraint criteria to ensure when the trigger command occurs, another command, referred to as the excluder, must not occur within the command list. Section 5.4.1.3 provides the record format.

4.2.4.1.4 Offset Rule Definition PDB

The Offset Rule Definition PDB provides the constraint criteria to support one of the Offset Rule types; No Commands After Rule, No Commands Before Rule, Repeat After Rule and No Remote Terminal (RT) Command Rule. Offset Rules ensures a command will not be issued before/after the offset time has expired. Section 5.4.1.4 provides the record format.

4.2.4.1.5 Prerule Definition PDB

The Prerule Definition PDB provides the constraint criteria to ensure a command, referred to as the satisfier, occurs prior to the trigger command within a specified time range. Additionally, an excluder command may be associated so as to not to occur between the satisfier and trigger commands in the same constraint rule. The rule definition may specify subfield and/or subfield bit criteria. Section 5.4.1.5 provides the record format.

4.2.4.1.6 Postrule Definition PDB

The Postrule Definition PDB provides the constraint criteria to ensure that a command, referred to as the satisfier, will occur within a specified time range after the trigger command is issued. The rule definition may specify subfield and/or subfield bit criteria. Section 5.4.1.6 provides the record format.

4.2.4.1.7 Scalar Rule Definition PDB

The Scalar Rule Definition PDB provides the constraint criteria to ensure the value of the trigger command's subfield satisfies the specified data value in association with its relational operator. Section 5.4.1.73 provides the record format.

4.2.4.1.8 Subfield Constraint Definition PDB

The Subfield Constraint Definition PDB provides the criteria for the command subfield in association with their constraint rule. Triggers, satisfiers, and excluders, as defined for the Comment Rule, Prerule and Postrule, may define constraint criteria at the subfield level. Section 5.4.1.8 provides the record format.

4.2.4.1.9 Subfield Bit Constraint Definition PDB Comment

The Subfield Bit Constraint Definition PDB provides the criteria for the command subfield bits in association with a constraint rule. The Comment Rule Definition PDB, the Prerule Definition PDB and the Postrule Definition PDB may specify constraint criteria at the command subfield bit level. Section 5.4.1.9 provides the record format.

4.2.4.2 Activity Constraint Files

4.2.4.2.1 Operational Mode Specification PDB

The Operational Mode Specification PDB identifies the operational state associated with an instrument, spacecraft subsystem or EOC ground system component. Each valid mode of a resource should be defined in this file. Section 5.4.2.1 provides the record format.

4.2.4.2.2 Operational Mode Transition Specification PDB

The Operational Mode Transition Specification PDB provides the valid operational state transitions for instruments, spacecraft subsystems or ground system components as defined at the mode-level. Section 5.42.2 provides the record format.

4.2.4.2.3 Event Specification PDB

The Event Specification PDB defines valid events used during mission planning. Section 5.4.2.3 provides the record format.

4.2.4.2.4 Activity Constraint Specification PDB

The Activity Constraint Specification PDB defines the activity-level constraints for instruments, spacecraft subsystems and ground system components. Section 5.4.2.4 provides the record format.

4.2.4.2.5 Consumable Constraint Specification PDB

The Consumable Constraint Specification PDB defines the maximum threshold for consumables, i.e., modeling parameters that can be consumed and replenished. Section 5.4.2.5 provides the record format.

4.3 PDB Record Structure

The following rules apply to all records in each PDB that is received at the EOC in file format:

- The format for each record must be in ASCII text.
- All records in a file must be in the same format and must be of a fixed length, as specified in Section 5, unless otherwise noted.
- Each record in a file must terminate with an ASCII new-line character.
- Fields in a record must be separated by the vertical bar "|" delimiter. (Delimiters are not enumerated in the record format.)

4.4 PDB Field Structure

The following rules apply to all record fields within each PDB input received at the EOC in file format:

- ASCII field may contain alphabetic, numeric and special characters.
- Field that contain values specified as integer are assumed to be decimal integer unless otherwise noted in the field description.
- The length of each field is specified in Section 5. If data in a field is shorter than the specified length, it must be padded with blanks. If an optional field has no data, it must be filled with blanks.
- To improve readability, all alphanumeric and other non numeric data should be left justified, and all numeric data should be right justified.
- Descriptor fields and those that are specified in their description are the only optional fields. All other fields are required fields and must contain data other than all blanks.
- The bits are ordered from left to right according to the Consultative Committee for Space Data Systems (CCSDS) Advanced Orbiting Systems (AOS) bit/byte numbering convention. Bit 0 is the most significant bit (MSB), bit 7 is the least significant bit (LSB).

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5. PDB Record Format Specifications

This section provides the format of each PDB record. Each record definition contains the record format, the record length, and a brief description of the fields in each record. The record length includes the new-line character, which marks the end of the record, and the vertical bar delimiter "|", which separates the fields within each record for a file. The description of each field provides the validation criteria performed on the PDB record.

5.1 Telemetry Records

5.1.1 Telemetry Packet Specification Record

The Telemetry Packet Specification Record defines valid CCSDS packets for processing by the FOS. The telemetry processing functions will use this information to extract the CCSDS standard source data packets from the telemetry EOS Data Operations System (EDOS) Data Units (EDUs).

Record Length: 91

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	4	4	Application process identifier (APID)
2	6	9	4	Packet length
3	11	90	80	Packet descriptor

Detailed Field Descriptions:

1. The application process identifier is specified with a four character decimal integer (0-2047) uniquely identifying the type of packet from the S-bank downlink to be decommutated by the FOS for the EOS S/C:

2. The packet length is specified as a four character decimal integer (1-1664) defining the expected length in bytes of the telemetry packet including the primary header, secondary header and application data field.

3. The packet descriptor is specified with 80 ASCII characters providing textual information describing the telemetry packet.

5.1.2 Telemetry Parameter Specification Record

The Telemetry Parameter Specification Record identifies analog and discrete telemetry parameters supporting the EOS spacecraft. Each record contains location information used to decommutate the downlink telemetry streams. A telemetry parameter is uniquely identified by the application process identifier, telemetry identifier, telemetry mnemonic, major cycle ID and the telemetry instance.

Record Length: 66

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	4	4	Application process identifier (APID)
2	6	10	5	Telemetry parameter identifier
3	12	31	20	Telemetry mnemonic
4	33	34	2	Major cycle ID
5	36	38	3	Telemetry instance
6	40	44	5	Packet offset
7	46	47	2	Composite size
8	49	50	2	Composite number
9	52	53	2	Size in bits
10	55	60	6	Delta time
11	62	65	4	Parameter data representation

Detailed Field Descriptions

1. The application process identifier is specified with a four character decimal integer (0-2047) identifying the type of packet from the S-bank downlink to be decommutated by the FOS.

   This value must also be defined in the Telemetry Packet Specification PDB.

2. The telemetry parameter identifier is specified as a five character decimal integer and uniquely represents the telemetry parameter. This value must also be defined in the Telemetry Description PDB.

3. The telemetry mnemonic identifies each parameter supporting telemetry processing for the EOS spacecraft. The telemetry mnemonic is a unique name consisting of 7-20 characters representing a telemetry point.

   AAA_BC_D...D

   where:

   AAA represents the spacecraft subsystem or instruments

   B represents the telemetry sample type

   C represents the telemetry point source type

   D represents 1 to 13 uppercase characters describing the telemetry point function.

4. The major cycle ID is specified as a two character decimal integer and uniquely identifies the major cycle number within a master cycle for the individual packet.

5. The telemetry instance is specified as a three character decimal integer and identifies the occurrence of the telemetry parameter within the packet. This value is used to indicate those telemetry points that occur more than once in the downlink packet (supercommutated). This value does not indicate the order in which the telemetry point occurs.

6. The packet offset is specified as a five character decimal integer and represents the bit offset within the packet where the most significant bit of a telemetry value is located. This value reflects the offset from the start of the application data.

7. The composite size is specified as a two-character decimal integer (1-8) indicating the total number of components for the parameter. The default value equals 1.

8. The composite number is specified as a two-character decimal integer indicating the number of the composite.

9. The size in bits is specified as a two character decimal integer (1-64) and indicates the number of bits in the data stream used to define the telemetry value. This value reflects the size for each component.

10. The delta time is specified as a six character decimal integer representing the time, in milliseconds, that must be added/subtracted to the spacecraft packet time stamp for each telemetry point to ensure accuracy of spacecraft events.

11. The parameter data representation is specified with four ASCII characters and represents the data type. Valid data types include:

UI	=	unsigned word integer	(1-32 bits)
SI	=	two's complement signed word integer	(1-32 bits)
Fl	=	single precision floating point in MIL-STD-1750A format	(32/48 bits)

5.1.3 Telemetry Description Record

The Telemetry Description Record provides descriptive information about a telemetry parameter.

Record Length: 215

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	5	5	Telemetry parameter identifier
2	7	26	20	Telemetry mnemonic
3	28	44	17	Major assembly name
4	46	75	30	Component name
5	77	106	30	Subassembly name
6	108	126	19	Remote terminal ID name
7	128	149	22	Telemetry type
8	151	151	1	Parameter type
9	153	153	1	SCC requirement flag
10	155	214	60	Telemetry description

Detailed Field Descriptions:

1. The telemetry parameter identifier is specified as a five character decimal integer and uniquely represents the telemetry parameter. This value must also be defined in the Telemetry Parameter Specification PDB or the Derived Telemetry Specification PDB.
2. The telemetry mnemonic is specified with 20 ASCII characters representing the name of the telemetry parameter.
3. The major assembly name is specified with 17 ASCII characters and identifies the source of the telemetry point.
4. The component name is specified with 30 ASCII characters and identifies the name of the end spacecraft component that is the source of the telemetry point.
5. The subassembly name is specified with 30 ASCII characters and identifies the name of the subassembly within the component that contains the telemetry circuit.
6. The remote terminal ID name is specified with 19 ASCII characters and indicates the name of the remote terminal on the C&T Bus that will transfer the sample telemetry to the CTIU.
7. The telemetry type is specified with 22 ASCII characters and identifies the classification of the telemetry point with respect to the spacecraft remote terminal and end component interface.
8. The parameter type is specified with one ASCII character identifying the type of parameter, where:

   A = ANALOG

   D = DISCRETE
9. The SSC requirement flag is specified with one ASCII character indicating the telemetry points that use the spacecraft controls computer for processing, where:

   N = not required by the SCC

   R = required by the SCC
10. The telemetry description is specified with 60 ASCII characters and provides textual information describing a telemetry point.

5.1.4 Telemetry EU Conversion Specification Record

The Telemetry EU Conversion Specification Record provides the necessary information for the conversion of a raw analog telemetry data number (DN) to an engineering unit (EU) such as amps or volts. The calibration scaling factor is used to allow very large or small numbers to be defined by a telemetry point. The scaling factor will be applied to each equation using the following format: EU = (1/2**scale factor) * (Calibration Equation) during the process of preparing the definitions for operational use. Additionally, information for conversion selection may be specified with a switch mnemonic and its min/max values. Each analog parameter may specify up to four different EU conversion equations. The segment number refer to the number of the segment. This value is set to 1 for unsegmented conversion types.

Record Length: 99

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	5	5	Telemetry parameter identifier
2	7	26	20	Telemetry mnemonic
3	28	32	5	Conversion type
4	34	37	4	Conversion group number
5	39	42	4	Calibration scaling factor
6	44	46	3	Data units
7	48	67	20	Conversion switch mnemonic
8	69	81	13	Minimum value
9	83	95	13	Maximum value
10	97	98	2	Segment number

Detailed Field Descriptions:

1. The telemetry parameter identifier is specified as a five character decimal integer and uniquely represents the telemetry parameter. This value must also be defined in the Telemetry Description PDB and of the parameter type analog.
2. The telemetry mnemonic is specified with 20 ASCII characters representing the name of the telemetry parameter. This name must also be defined in the Telemetry Description PDB in combination with its telemetry parameter id.
3. The conversion type is specified with five ASCII characters indicating the type of calibration conversion to be performed on the telemetry point. Valid values include:

U_2D	=	unsegmented_2D	EU = C0 + C1X + C2X**2
U_3D	=	unsegmented_3D	EU = C0 + C1X + C2X**2 + C3X**3
U_4D	=	unsegmented_4D	EU = C0 + C1X + C2X**2 + C3X**3 + C4X**4
U_5D	=	unsegmented_5D	EU = C0 + C1X + C2X**2 + C3X**3 + C4X**4 + C5X**5
U_6D	=	unsegmented_6D	EU = C0 + C1X + C2X**2 + C3X**3 + C4X**4 + C5X**5 + C6X**6
U_7D	=	unsegmented_7D	EU = C0 + C1X + C2X**2 + C3X**3 + C4X**4 + C5X**5 + C6X**6 + C7X**7
U_EXP	=	unsegmented_EXP	EU = C0 + C1e**(C2X)
LINE	=	line segment	

e - represents the natural constant (2.71828182846)

4. The conversion group number is specified as a four character decimal integer identifying the set of polynomial or linear coefficients to be used in the conversion equation. This

number must also be defined in the Polynomial Coefficients Specification PDB or the Linear Coefficient Specification. PDB as indicated by the conversion type (field 3).

5. The calibration scaling factor is specified as a four character decimal integer defining the power of 2 by which the calibration equation is divided by: EU = (1/2**SF)*(Calibration Equation). A default value of zero indicates scaling is not performed on the telemetry point.

6. The data units is specified with three ASCII characters and represents an abbreviation for the engineering units to which a raw telemetry data number is converted to.

7. The conversion switch mnemonic is specified with 20 ASCII characters identifying the telemetry parameter whose value determines the equation to use when performing EU conversion. This name must be defined in the Telemetry Description PDB

8. The minimum value is specified as a 13-character decimal integer. This value represents the lower limit, inclusively, of the range of values of the conversion switch mnemonic (field 7) for which the parameter will use the associated conversion equation. This value must be less than or equal to the maximum switch value (field 9).

9. The maximum value is specified as a 13-character decimal integer. This value represents the upper limit, inclusively, of the range of values of the conversion switch mnemonic (field 7) for which the parameter will use the associated conversion equation. This value must be greater than or equal to the minimum switch value (field 8).

10. The segment number is specified with a two-character decimal integer. This value represent the number of the segment. This value is set to 1 for unsegmented conversion types.

5.1.5 Polynomial Coefficients Specification Record

The Polynomial Coefficients Specification Record defines the coefficients used to convert raw telemetry values into EUs using a polynomial equation. Each conversion equation is identified by a conversion group number and name. Multiple telemetry parameters may access the same conversion equation by its group number. Equations up to the seventh order may be stored for any one group, with the number of valid coefficients dependent on the type of conversion.

Record Length: 159

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	4	4	Conversion group number
2	6	30	25	Conversion group name
3	32	46	15	Coefficient #0
4	48	62	15	Coefficient #1
5	64	78	15	Coefficient #2
6	80	94	15	Coefficient #3
7	96	110	15	Coefficient #4
8	112	126	15	Coefficient #5
9	128	142	15	Coefficient #6
10	144	158	15	Coefficient #7

Detailed Field Descriptions:

1. The conversion group number is specified with a 4-character decimal integer and uniquely identifies a set of coefficients associated with a conversion equation.

2. The conversion group name is specified with 25 ASCII characters and represents a set of coefficients by name.

3. Coefficient #0 is specified with a 15-character floating-point number representing the value of the constant in the equation.

4. Coefficient #1 is specified with a 15-character floating-point number representing the value of the coefficient for the first order in the equation.

5. Coefficient #2 is specified with a 15-character floating-point number representing the value of the coefficient for the second order in the equation.

6. Coefficient #3 is specified with a 15-character floating-point number representing the value of the coefficient for the third order in the equation.

7. Coefficient #4 is specified with a 15-character floating-point number representing the value of the coefficient for the fourth order in the equation.

8. Coefficient #5 is specified with a 15-character floating-point number representing the value of the coefficient for the fifth order in the equation.

9. Coefficient #6 is specified with a 15-character floating-point number representing the value of the coefficient for the 6th order in the equation.

10. Coefficient #7 is specified with a 15-character floating-point number representing the value of the coefficient for the 7th order in the equation.

5.1.6 Linear Conversion Specification Record

The Linear Conversion Specification Record defines the coefficients used to convert raw telemetry values into EUs using a linear equation. Each conversion equation is identified by a conversion group number and name. Multiple telemetry parameters may access the same linear equation by its group number. Linear equation with up to 15 pairs of start and end points may be specified. The start points for the next raw/converted values represent the end points for the previous raw/converted values. The 16th point pair represents the end points for the 15th line segment.

Record Length: 543

Record Format:

Field #	Start Byte	End Byte	Total Bytes	Content
1	1	4	4	Linear group number
2	2	6	25	Linear name
3	32	46	15	Raw-1
4	48	62	15	Converted-1
5	64	78	15	Raw-2
6	80	94	15	Converted-2
. . .	. . .	. . .	. . .	
33	512	526	15	Raw-16
34	528	542	15	Converted-16

Detailed Field Descriptions:

1. The linear group number is specified with a 4- character decimal integer and uniquely identifies a set of coefficients associated with a linear equation.

2. The linear name is specified with 25 ASCU characters and represents a set of coefficients by name.

3. The raw value 1 is specified with a 15-character decimal integer representing the start point, value x, for the first line segment.

4. The converted value 1 is specified with a 15-character floating point number representing the converted start point for the first line segment, value y.

5. The raw value -2 is specified with a 15-character decimal integer representing the end point, value x, for the first line segment. Additionally, this value also represents the start point, value x, for the second line segment.

6. The converted value -2 is specified with a 15-character floating point number representing the end point, value y, for the first line segment. Additionally, this value also represents the start point, value y, for the second line segment.

.
.
.

33. The raw value -16 is specified with a 15-character decimal integer representing the end point, value x, for the 15th line segment.

34. The converted value -16 is specified with a 15-character floating point number representing the end point, value y, for the 15th line segment.

5.1.7 Red/Yellow Limit Specification Record

The Red/Yellow Limit Specification Record defines the red/yellow - high/low limit checking criteria associated with an analog, discrete or derived telemetry parameter. A yellow out-of-limits condition indicates the component is no longer healthy and action should be taken to prevent a hazardous situation. A red out-of-limits condition indicates the component is in imminent danger of suffering damage and immediate action is required. Each parameter may specify up to four limit sets defining these conditions.

Record Length: 96

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	5	5	Telemetry parameter identifier
2	7	26	20	Telemetry mnemonic
3	28	28	1	Limit set number
4	30	31	2	DN/EU indicator
5	33	47	15	Red low limit
6	49	63	15	Yellow low limit
7	65	79	15	Yellow high limit
8	81	95	15	Red high limit

Detailed Field Descriptions:

1. The telemetry parameter identifier is specified as a five character decimal integer and uniquely represents the telemetry parameter. This value must also be defined in the Telemetry Description Specification PDB.

2. The telemetry mnemonic is specified with 20 ASCII characters representing the name of the telemetry parameter. The format for this name is specified in Section 5.1.2. This name must also be defined in the Telemetry Description Specification PDB in combination with its telemetry parameter id.

3. The limit set number is specified as a one character decimal integer (1-4) identifying the set of limits associated with the telemetry parameter. Each parameter may define up to 4 limit sets. Set numbers must be used in order beginning with number 1, i.e., limit set 3 cannot be defined unless limit set 2 has been defined.

4. The DN/EU indicator is specified with two ASCII characters indicating the units a limit value is defined as, i.e. raw data number or engineering units, where:

   DN = raw data number

   EU = engineering units

   This field is only used for analog telemetry parameters, therefore the telemetry parameter must be of the parameter type analog. Additionally, a parameter with its limit set expressed in engineering units must also specify a conversion type in it's associated Telemetry EU Conversion Specification PDB. All limit sets for a particular parameter must be defined as DN or EU but not a combination of the both.

5. The red low limit is specified with 15-characters defining the low dangerous limit value for the telemetry parameter. The format for this field is determined by the DN/EU indicator (field 4). A DN/EU indicator set to DN indicates this value will be defined as a raw data number and contains a decimal integer. A DN/EU indicator set to EU indicates this value will be defined in engineering units and contains a floating-point number. This value must be less then the yellow low limit (field 6).

6. The yellow low limit is specified with 15-characters defining the low warning limit value for the telemetry parameter. The format for this field is determined by the DN/EU indicator (field 4). A DN/EU indicator set to DN indicates this value will be defined as a raw data number and contains a decimal integer. A DN/EU indicator set to EU indicates this value will be defined in engineering units and contains a floating-point number. This value must be greater than the red low limit (field 5) and less then the yellow high limit (field 7).

7. The yellow high limit is specified with 15-characters defining the high warning limit value for the telemetry parameter. The format for this field is determined by the DN/EU indicator (field 4). A DN/EU indicator set to DN indicates this value will be defined as a raw data number and contains a decimal integer. A DN/EU indicator set to EU indicates this value will be defined in engineering units and contains a floating-point number. This value must be greater then the yellow low limit (field 6) and less then the red high limit (field 8).

8. The red high limit is specified with 15-characters defining the high dangerous limit value for the telemetry parameter. The format for this field is determined by the DN/EU indicator (field 4). A DN/EU indicator set to DN indicates this value will be defined as a raw data number and contains a decimal integer. A DN/EU indicator set to EU indicates this value will be defined in engineering units and contains a floating-point number. This value must be greater then the yellow high limit (field 7).

5.1.8 Limit Selection Specification Record

The Limit Selection Specification Record defines the criteria for selecting a limit set for a telemetry parameter. The value of the parameter defined by the limit switch mnemonic will indicate the limit set to use. Each parameter may define up to four limit sets.

Record Length: 78

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	5	5	Telemetry parameter identifier
2	7	26	20	Telemetry mnemonic
3	28	28	1	Limit set number
4	30	49	20	Limit switch mnemonic
5	51	63	13	Minimum switch value
6	65	77	13	Maximum switch value

Detailed Field Descriptions:

1. The telemetry identifier is specified as a five character decimal integer and uniquely represents the telemetry parameter. This value must also be defined in the Red/Yellow Limit Specification PDB.

2. The telemetry mnemonic is specified with 20 ASCII characters representing the name of the telemetry parameter. The format for this name is specified in Section 5.1.2. This name must also be defined in the Red/Yellow Limit Specification PDB in combination with its telemetry parameter id.

3. The limit set number is specified as a one character decimal integer (1-4) identifying the limit set associated with the telemetry parameter (field 1). Each parameter may define up to 4 limit sets. Set numbers must be used in order beginning with number 1, i.e., limit set 3 cannot be defined unless limit set 2 has been defined. This number must also be defined in the Red/Yellow Limit Specification PDB in association with it's telemetry parameter id (field 1) and mnemonic (field 2)

4. The limit switch mnemonic is specified with 20 ASCII characters identifying a telemetry parameter whose value determines the limit set to use when performing limit checking. The format for this name is specified in Section 5.1.1. This name must be defined in the Telemetry Description PDB

5. The minimum switch value is specified as a 13-character decimal integer identifying the lower limit, inclusively, of the range of values of the limit switch mnemonic (field 4) for which the parameter will be limit checked. This value must be less than or equal to the maximum switch value (field 6).

6. The maximum switch value is specified as a 13-character decimal integer identifying the upper limit, inclusively, of the range of values of the limit switch mnemonic (field 4) for which the parameter will be limit checked. This value must be greater than or equal to the minimum switch value (field 5).

5.1.9 Delta Limit Specification Record

The Delta Limit Specification Record defines delta limit checking criteria associated with a telemetry parameter. Delta limits refers to the maximum difference between two consecutive samples that is considered normal. Each telemetry parameter may define one delta limit.

Record Length: 46

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	5	5	Telemetry parameter identifier
2	7	26	20	Telemetry mnemonic
3	28	29	2	DN/EU indicator
4	31	45	15	Delta limit value

Detailed Field Descriptions:

1. The telemetry parameter identifier is specified as a five character decimal integer representing a telemetry parameter. This value must also be defined in the Telemetry Description Specification PDB

2. The telemetry mnemonic is specified with 20 ASCII characters representing the name of the telemetry parameter. The format for this name is specified in Section 5.1.2. This name must also be defined in the Telemetry Description Specification in combination with its telemetry parameter id.

3. The DN/EU indicator is specified with two ASCII characters indicating the units a delta limit value is defined as, i.e. raw data number or engineering units, where:

   DN = raw data number

   EU = engineering units

   This field is only used for analog telemetry parameters, therefore the telemetry parameter must be of type analog. Additionally, a parameter with its delta limit expressed in engineering units must specify a conversion type in it's associated Telemetry EU Conversion Specification PDB.

4. The delta limit value is specified with 15 characters defining the maximum absolute successive change allowed for this telemetry parameter. The format for this field is determined by the DN/EU indicator (field 3). A DN/EU indicator set to DN indicates this value will be defined as a raw data number and contains a decimal integer. A DN/EU indicator set to EU indicates this value will be defined in engineering units and contains a floating point number.

5.1.10 Discrete States Specification Record

The Discrete States Specification Record associates a single text state to a range of values for a discrete telemetry parameter. This text is the discrete state of the parameter and is used by FOS User Interface Subsystem. Each discrete telemetry parameter may have up to 32 different ranges specified.

Record Length: 66

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	5	5	Telemetry parameter identifier
2	7	26	20	Telemetry mnemonic
3	28	40	10	Minimum range value
4	39	48	10	Maximum range value
5	50	65	16	Discrete state text

Detailed Field Descriptions:

1. The telemetry parameter identifier is specified as a five character decimal integer representing a discrete telemetry parameter. This value must also be defined in the Telemetry Description PDB and of the parameter type discrete.

2. The telemetry mnemonic is specified with 20 ASCII characters representing the name of the telemetry parameter. The format for this name is specified in Section 5.1.2. This name must also be defined in the Telemetry Descriptor PDB in combination with its telemetry parameter id.

3. The minimum range value is specified as a 10-character decimal integer representing the low-order end of the discrete range. The minimum range value must be less than or equal to the maximum range value (field 4).

4. The maximum range value is specified as a 10-character decimal integer representing the high-order end of the discrete range. The maximum range value must be greater than or equal to the maximum range value (field 3).

5. The discrete state text is specified with 16 ASCII characters and provides the text associated with the discrete range (fields 3 and 4).

5.1.11 Context Dependent Specification Record

The Context Dependent Specification Record defines the condition in which a telemetry parameter is decommutated from its defined location. The value of a context switch parameter is used to determine whether the associated telemetry parameter will be decommutated. Each location may have up to 16 parameters defined using the context switch and a distinct range to identify it.

Record Length: 70

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	5	5	Telemetry parameter identifier
2	7	26	20	Telemetry mnemonic
3	28	47	20	Context switch mnemonic
4	49	58	10	Context low value
5	60	69	10	Context high value

Detailed Field Descriptions:

1. The telemetry parameter identifier is specified as a five character decimal integer representing a telemetry parameter. This value must also be defined in the Telemetry Description Specification PDB.

2. The telemetry mnemonic is specified with 20 ASCII characters representing the name of the telemetry parameter. The format for this name is specified in Section 5.1.2. This name must also be defined in the Telemetry Description Specification PDB in combination with its telemetry parameter id.

3. The context switch mnemonic is specified with 20 ASCII characters identifying the telemetry parameter whose value determines whether decommutation of the telemetry parameter (field 1) will be performed from its defined location. The format for this name is specified in Section 5.1.2. This name must be defined in the Telemetry Description PDB

4. The context low value is specified with a 10-character decimal integer representing the lower limit, inclusive, of the range of values of the context switch parameter (field 3) for which the telemetry parameter (field 1) will be decommutated. This value must be less then or equal to the context high value (field 5).

5. The context high value is specified with a 10-character decimal integer representing the upper limit, inclusive, of the range of values of the context switch parameter (field 3) for which the telemetry parameter (field 1) will be decommutated. This value must be greater then or equal to the context low value (field 4).

5.1.12 Derived Telemetry Specification Record

The Derived Telemetry Specification Record defines simple equations that combine previously defined analogs, discretes, constants and other derived parameters via arithmetic or logical

functions. Each derived equation may specify up to 6 input parameters. The number of derived parameters supported at a given time shall not exceed 50. NOTE: No inherent order of precedence exists, therefore, operators are evaluated in the order specified.

Record Length: 197

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	5	5	Derived parameter identifier
2	7	26	20	Derived telemetry mnemonic
3	28	30	3	Derived units
4	32	33	2	Computation rate
5	35	54	20	Input operand 1
6	56	56	1	Calibration flag 1
7	58	61	4	Operator 1
8	63	82	20	Input operand 2
9	84	84	1	Calibration flag 2
10	86	89	4	Operator 2
11	91	110	20	Input operand 3
12	112	112	1	Calibration flag 3
13	114	117	4	Operator 3
14	119	138	20	Input operand 4
15	140	140	1	Calibration flag 4
16	142	145	4	Operator 4
17	147	166	20	Input operand 5
18	168	168	1	Calibration flag 5
19	170	173	4	Operator 5
20	175	194	20	Input operand 6
21	196	196	1	Calibration flag 6

Detailed Field Descriptions:

1. The derived parameter identifier is specified as a five character decimal integer and uniquely represents the derived parameter. This value is system generated.

2. The derived telemetry mnemonic is specified with 20 ASCII characters identifying the telemetry parameter whose value is derived from other existing parameters in a mathematical operation. The format for this name is specified in Section 5.1.2. This value must also be defined in the Telemetry Description Specification PDB.

3. The derived units is specified with three ASCII characters describing the physical presentation of the derived telemetry parameter. This field will be used for display/reporting purposes only and therefore will not be validated.

4. The computation rate is specified as a two character decimal integer indicating the rate at which the equation result is computed in seconds.

5. The input operand 1 is specified with 20 ASCII characters representing the telemetry parameter to be used in the mathematical equation. Valid parameters include analog; discrete; constant; or other derived parameters. The format for this name is specified in Section 5.1.2. This name must also be defined in the Telemetry Description Specification PDB if it is an analog, discrete or derived parameter; or it must be defined in the Telemetry Constant Specification PDB if it is a constant parameter; or if defined as derived it must also be previously defined in the Derived Telemetry Specification PDB if it is another derived parameter.

6. The calibration flag 1 is specified with one ASCII character indicating whether the parameter represented by input operand 1 is to be calibrated, where:

   Y = yes, calibrate parameter

   N = no, calibration not performed

   Calibration is only performed on analog parameters. A value of Y, therefore, is valid only when input operand 1 (field 4) is an analog parameter.

7. Operator 1 is specified with four ASCII characters and represents the mathematical operator used within the mathematical equation. Valid operators include the following:

+	addition
-	subtraction
-	negation
*	multiplication
/	division
SIN	sine
ASIN	arcsin
COS	cosine
ACOS	arccosine
TAN	tangent
ATAN	arctangent
=	equal to
!=	not equal to
<	less than
<=	less than or equal to
>	greater than

>=	greater than or equal to
&&	logical AND
‖	logical OR
!	logical NOT
.	.
.	.

19. Operator 5 - refer to field 7
20. The input operand 6 - refer to field 5
21. The calibration flag 6 - refer to field 6

5.1.13 Telemetry Constant Specification Record

The Telemetry Constant Specification Record defines the constant values required to support telemetry processing. Each record defines a constant value which may be provided as input into a derived equation.

Record Length: 147

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	5	5	Telemetry constant identifier
2	7	26	20	Telemetry constant mnemonic
3	28	41	4	Constant type
4	43	65	23	Constant value
5	67	146	80	Constant descriptor

Detailed Field Descriptions:

1. The telemetry constant identifier is specified as a five character decimal integer and uniquely represents a constant value. This value is system generated.
2. The telemetry constant mnemonic is specified with 20 ASCII characters representing the constant value used with derived parameters, equation processing or as user specified constants. The format for this name is specified in Section 5.1.2.
3. The constant type is specified with four ASCII characters representing the data type of the constant, where

UB	=	unsigned byte integer	(8 bits)
UI	=	unsigned word integer	(16 bits)
ULI	=	unsigned long word integer	(32 bits)
SB	=	two's complement signed byte integer	(8 bits)

SI	=	two's complement signed word integer	(16 bits)
SLI	=	two's complement signed long word integer	(32 bits)
1750	=	single precision floating point in MIL-STD-1750A format	(32 bits)
BOOL	=	Boolean value	(5 bytes)
STIM	=	short time UTC format	(32 bits)
TIME	=	standard time UTC format	(64 bits)
DTIM	=	standard delta time format	(64 bits)
CHAR	=	ASCII character string	(23 bytes)

4. The constant value specifies the default value assigned to the constant identifier. For constant types of integer, this value is considered a decimal integer value unless specified with the character "X" for hexadecimal or "O" for octal. For constant types of Boolean, acceptable values are TRUE or FALSE. For constant types of time, the format of the constant value is:

   YY:DDD:HH:MM:SS.mmm.uuu

   where:

YY	=	year (95-99 for 1995-1999, 00-50 for 2000-2050)
DDD	=	day (001-366)
HH	=	hour (00-23)
MM	=	minute (00-59)
SS	=	second (00-59)
mmm	=	millisecond (000-999)
uuu	=	microsecond (000-999)

5. The constant descriptor is specified with 80 ASCII characters providing textual information describing the telemetry constant.

5.1.14 Telemetry Long Description Record

The Telemetry Long Description Record provides a detailed description for a telemetry parameter.

Record Length: 1628

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	5	5	Telemetry parameter identifier
2	7	26	20	Telemetry mnemonic
3	28	1627	1600	Telemetry long description

Detailed Field Descriptions:

1. The telemetry parameter identifier is specified as a five character decimal integer and uniquely represents the telemetry parameter. This value must also be defined in the Telemetry Description PDB.
2. The telemetry mnemonic is specified with 20 ASCII characters representing the name of the telemetry parameter. The format for this name is specified in Section 5.1.2. This name must also be defined in the Telemetry Description PDB in combination with its telemetry parameter id.
3. The telemetry long description is specified with 1600 ASCII characters providing a detailed description of the telemetry parameter.

5.2 Command Records

5.2.1 Command Parameter Specification Record

The Command Parameter Specification Record defines a spacecraft or instrument command which is used to support the EOS spacecraft. Each record provides the construction information for a command.

Record Length: 86

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	5	5	Command parameter identifier
2	7	26	20	Command mnemonic
3	28	42	15	Command type
4	44	62	19	Remote terminal ID name
5	64	80	17	Remote terminal subaddress name
6	82	83	2	Command word count
7	85	85	1	Command data word type
8	87	87	1	Safety level

Detailed Field Descriptions:

1. The command parameter identifier is specified with a five character decimal integer uniquely identifying the spacecraft or instrument command parameter.
2. The command mnemonic identifies the each spacecraft or instrument command parameter. The command mnemonic is a unique name consisting of 14-20 characters representing a spacecraft or instrument command for the EOS spacecraft; the format is specified as follows:

   AAA_<Command Verb>_<Command Name>

   where:

   AAA is three uppercase characters representing spacecraft subsystem or instruments;

<Command Verb> is specified with 3 to 9 uppercase characters representing the command verb; valid values for the EOS spacecraft include:

ACTIVATE

ARM

BOOT

CHANGE

CLOSE

DISABLE

DISARM

DRIVE

DUMP

ENABLE

FIRE

FLYBACK

FORCEOFF

FORCEON

GET

HALT

IGNORE

INITIATE

LOAD

MLOAD

MOVE

OPEN

PASS

PERFORM

RESET

SELECT

SET

SLEW

STEP

TOGGLE

TURN_OFF

TURN_ON

USE

<Command Name> specifies 6 to 12 uppercase characters representing the command name describing the function to be performed on-board the spacecraft. The actual length of the command name is dependent on the command verb.

3. The command type is specified with 15 ASCII characters identifying the command classification with respect to the RT and end component interface.

4. The remote terminal (RT) ID name is specified with 19 ASCII characters identifying the name of the remote terminal to which a command is sent to over the 1553 Command and Telemetry (C&T) bus.

5. The RT subaddress name is specified with 17 ASCII characters representing the name of the remote terminal subaddress the command is sent to.

6. The command word count is specified as a two character decimal integer (1-32) indicating the number of 16-bit words which follow the command destination (1553 message header) in the command structure. The command descriptor and optional command data words are included in this count. A value greater than 1 would indicate command data words exist.

7. The command data word type is specified with one ASCII character representing the source of the command data, where:

   F = FIXED; assembled from a fixed bit pattern
   V = VARIABLE; user specified

   Note: A FIXED command data word type would indicate the presence of fixed type command data words associated with the command. A VARIABLE command data word type may also contain a fix part of the bit pattern and therefore would have both fixed and variable type command data words.

8. The safety level is specified with one ASCII character indicating whether the command is critical to the spacecraft hardware and/or personnel. Valid values include:

   H = HAZARDOUS (Critical)
   S = SAFE
   E = EXCLUDE - Indicates the command is to be excluded from the command process
   O = One time only - Indicates commands that are sent one time only

5.2.2 Command Description Record

The Command Description Record provides descriptive information about a spacecraft or instrument command parameter.

Record Length: 188

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	5	5	Command parameter identifier
2	7	26	20	Command mnemonic
3	28	44	17	Major assembly
4	46	75	30	Component name
5	77	106	30	Subassembly name
6	108	110	3	ATC inhibit ID
7	112	112	1	Stored command indicator
8	114	114	1	Pseudo OPS
9	116	195	80	Command description

Detailed Field Descriptions:

1. The command identifier is specified as a five character decimal integer and uniquely represents the command parameter. This value must also be specified in the Command Parameter Specification PDB.

2. The command mnemonic is specified with 20 ASCII characters representing the name of the command parameter. The format for this name is defined in Section 5.2.1. This value must also be specified in the Command Parameter Specification PDB in combination with the command parameter id.

3. The major assembly is specified with 17 ASCII characters and identifies the name of the spacecraft major assembly which contains the component that will receive the command.

4. The component name is specified with 30 ASCII characters and is used to identify the spacecraft component that receives the command.

5. The subassembly name is specified with 30 ASCII characters and is used to identify the name of the subassembly within the component that will be affected by the command. This value is not required by all commands.

6. The ATC inhibit ID is specified with a 3-character decimal integer (0-255) indicating the inhibit group of the command.

7. The store command indicator is specified as a 1-character decimal integer indicating whether the command is executable from the ATC or RTS buffer.

   Where:

   0 = false, not executable

1 = true, executable

8. The pseudo operations frequency is specified as a 1-character decimal integer indicating the type of command.

   Where:

   0 = normal

   1 = activate RTS

   2 = jump

   3 = no op

   4 = halt

6. The command short description is specified with 80 ASCII characters and provides textual information describing the spacecraft or instrument command.

5.2.3 Command Fixed Data Word Specification Record

The Command Fixed Data Word Specification Record defines the data words (1-N) associated with the fixed bit pattern of a command. Word 1 would represent the command destination and word 2 represents the command descriptor.

Record Length: 35

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	5	5	Command parameter identifier
2	7	26	20	Command mnemonic
3	28	29	2	Word number
4	31	34	4	Command data value

Detailed Field Descriptions:

1. The command parameter identifier is specified with a five character decimal integer uniquely identifying the spacecraft or instrument command parameter. This value must be specified in the Command Parameter Specification PDB.

2. The command mnemonic is specified with 20 ASCII characters representing the name of the command parameter. The format for this name is defined in Section 5.2.1. This value must also be specified in the Command Parameter Specification PDB in combination with the command parameter id.

3. The word number is specified as a two character decimal integer (1-33) and indicates the order of data words associated with a command.

4. The command data value is specified as a four-character hexadecimal value indicating the fixed bit pattern of the data word.

5.2.4 Command Variable Data Word Specification Record

The Command Variable Data Word Specification Record defines the subfields associated with variable type commands. Each subfield defines a parameter associated with a command that is to be specified at execution time. Each command of variable type may reference up to 10 subfield names. Optional conversion equation and up to 10 state names may be associated with each subfield. A third order polynomial may be used to reverse calibrate an input subfield value from an EU to a DN using the equation as follows: DN = C0 + C1*EU + C2*EU**2 = C3*EU**3.

Record Length: 108-453

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	5	5	Command parameter identifier
2	7	26	20	Command mnemonic
3	28	47	20	Subfield name
4	48	60	13	Default value
5	62	65	4	Subfield length
6	67	70	4	Destination first bit
7	72	75	4	Destination last bit
8	77	89	13	Minimum subfield value
9	91	103	13	Maximum subfield value
10	105	107	3	Units
11	109	112	4	Conversion group number 1
12	114	126	13	Start EU number 1
13	128	131	4	Conversion group number 2
14	133	145	13	Start EU number 2
15	147	162	16	State 1
16	164	175	13	State 1 value
.				.
.				.
33	423	438	16	State 10
34	440	452	13	State 10 value

Detailed Field Descriptions:

1. The command parameter identifier is specified with a five character decimal integer uniquely identifying the spacecraft or instrument command parameter. This value must be specified in the Command Parameter PDB.

2. The command mnemonic is specified with 20 ASCII characters representing the name of the command parameter. The format for this name is defined in Section 5.2.1. This value

must also be specified in the Command Parameter Specification PDB in combination with the command parameter id.

3. The subfield name is specified with 20 ASCII characters and identifies the name of a subfield associated with a variable type command.

4. The default value is specified with a 13 character floating point value indicating the value to be used if no value is specified when the command is issued. This value is represented as a data number (DN).

5. The subfield length is specified as a two character decimal integer (1-32) indicating the number of bits constituting the subfield value within the command bit pattern.

6. The destination first bit is specified as a four character decimal integer indicating the first bit of the command bit pattern where the subfield value will be inserted in the command data message.

7. The destination last bit is specified as a four character decimal integer indicating the last bit of the command bit pattern where the subfield value will be inserted in the command data message.

8. The minimum value is specified with a 13 character floating point value representing the lower bound for the associated state of the subfield value range.

9. The maximum value is specified with a 13 character floating point value representing the upper bound of the subfield value range.

10. The units is specified with three ASCII characters representing an abbreviation for the engineering units to which a command subfield value is converted from.

11. The conversion group number 1 is specified with a four character decimal integer and uniquely identifies a set of coefficients associated with an unsegmented 3rd order polynomial equation to be used when the subfield value is greater than or equal to the start EU number 1 (field 12) and less then the start EU number 2 (field 14). This value must be defined in the Polynomial Coefficients Specification PDB. The equation used to reverse calibrate is as follows: DN = C0 + C1*EU + C2*EU**2 + C3*EU**3.

12. The start EU number 1 is specified with a 13 character floating point value representing the lower bound of values for conversion group number 1 (field 11).

13. The conversion group number 2 is specified with a four character decimal integer and uniquely identifies a set of coefficients associated with a conversion equation to be used when the subfield value is greater than or equal to start EU number 2 (field 14). This value must be defined in the Polynomial Coefficients Specification PDB. The equation is specified in field 11.

14. The start EU number 2 is specified with a 13 character floating point value representing the lower bound of values for conversion group number 2 (field 13).

15. The state name 1 is specified with 16 ASCII characters representing a state associated with the subfield.

16. The state value 1 is specified with a 13 character floating point value representing the value to be inserted into the command bit pattern when the user enters state name 1 (field 15).

.

.

33. The state name 10 is specified with 16 ASCII characters representing a state associated with the subfield.

34. The state value 10 is specified with 13 character floating point value representing the command bit pattern to be inserted when the user enters state name 10 (field 33).

5.2.5 Command Execution Verification (CEV) Record

The Command Execution Verification (CEV) Specification Record defines a telemetry parameter used to verify the reception and execution of an associated command by the spacecraft subsystem or instrument. Each command parameter may specify one analog or discrete telemetry parameter to verify execution. An range of values in which the telemetry parameter must occur is specified to verify command execution. To indicate an exact value for the telemetry parameter, the low value and high value must be equal.

Record Length: 130

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	5	5	Command parameter identifier
2	7	26	20	Command mnemonic
3	28	47	20	CEV mnemonic
4	49	50	2	DN/EU indicator
5	52	66	15	CEV low value
6	68	82	15	CEV high value
7	84	95	12	CEV time out
8	97	112	16	CEV mask
9	114	129	16	CEV state

Detailed Field Descriptions:

1. The command parameter identifier is specified with a five character decimal integer uniquely identifying the spacecraft or instrument command parameter. This value must be specified in the Command Parameter Specification PDB.

2. The command mnemonic is specified with 20 ASCII characters representing the name of the command parameter. The format for this name is defined in Section 5.2.1. This value must also be specified in the Command Parameter Specification PDB in combination with the command parameter id.

3. The CEV mnemonic is specified with 20 ASCII characters representing the telemetry parameter whose value verifies the receipt and execution of the command. The format for this name is specified in Section 5.1.2. This name must be specified in the Telemetry Description PDB.

4. The DN/EU indicator is specified with two ASCII characters indicating the units the CEV mnemonic is defined as, i.e. raw data number or engineering units, where:

   DN = raw data number

   EU = engineering units

   This field is only used for analog telemetry parameters, therefore the telemetry parameter must be of type analog. Additionally, a CEV mnemonic expressed in engineering units must also have an associated definition in the Polynomial Coefficients Specification PDB.

5. The CEV low value is specified with 15-characters defining the lowest acceptable value, inclusive, of the CEV mnemonic to verify the command has been properly executed onboard the spacecraft. This value cannot be greater than the CEV high value (field 6). The format for this field is determined by the DN/EU indicator (field 4). A DN/EU indicator set to DN indicates this value will be defined as a raw data number and contains a decimal integer. A DN/EU indicator set to EU indicates this value will be defined in engineering units and contains a floating-point number.

6. The CEV high value is specified with 15-characters defining the highest acceptable value, inclusive, of the CEV mnemonic to verify the command has been properly executed onboard the spacecraft. This value cannot be less than the CEV low value (field 5). The format for this field is determined by the DN/EU indicator (field 4). A DN/EU indicator set to DN indicates this value will be defined as a raw data number and contains a decimal integer. A DN/EU indicator set to EU indicates this value will be defined in engineering units and contains a floating-point number.

7. The CEV time out is specified as a 12 character floating point value indicating the maximum time in seconds for verification of the transmitted command to occur before it is considered to have failed.

8. The CEV mask is specified with 16 ASCII characters representing the bit pattern in hexadecimal format that is logically combined with the expected value and the value of the telemetry point used to verify the command. The mask concept provides the capability to have a multi-bit telemetry point serve as the CEV mnemonic for a command that will only cause 1 bit of the multi-bit point to change.

9. The CEV state is specified with 16 ASCII characters and provides the text associated with the CEV mnemonic used to verify command execution. This value will override the use of the expected value (fields 5 & 6) when both are specified.

5.2.6 Prerequisite State Specification Record

The Prerequisite State Specification Record defines the condition for which a telemetry parameter associated with a command must occur in order to perform prerequisite state checking. Each command may specify up to 4 analog or discrete telemetry parameters with an associated range of values. A command will be transmitted only if all telemetry parameters defined for this command fall within their specified range. To indicate an exact value for the telemetry parameter, the low value and high value must be equal.

Record Length: 83

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	5	5	Command parameter identifier
2	7	26	20	Command mnemonic
3	28	47	20	Prerequisite mnemonic
4	49	50	2	DN/EU indicator
5	52	66	15	Prerequisite low value
6	68	82	15	Prerequisite high value

Detailed Field Descriptions:

1. The command parameter identifier is specified with a five character decimal integer uniquely identifying the spacecraft or instrument command parameter. This value must be specified in the Command Parameter Specification PDB.

2. The command mnemonic is specified with 20 ASCII characters representing the name of the command parameter. The format for this name is defined in Section 5.2.1. This value must also be specified in the Command Parameter Specification PDB in combination with the command parameter id.

3. The prerequisite mnemonic is specified with 20 ASCII characters representing a telemetry parameter whose value is used in determining whether the command is to be transmitted. The format for this name is specified in Section 5.1.2. This value must also be defined in the Telemetry Description PDB.

4. The DN/EU indicator is specified with two ASCII characters indicating the units the prerequisite mnemonic is defined as, i.e. raw data number or engineering units, where:

   DN = raw data number

   EU = engineering units

   This field is only used for analog telemetry parameters, therefore the telemetry parameter must be of type analog. Additionally, a prerequisite mnemonic expressed in engineering units must also have an associated definition in the Polynomial Coefficients Specification PDB.

5. The prerequisite low value is specified with 15-characters defining the lowest acceptable value, inclusive, of the prerequisite mnemonic to verify the condition for sending the associated command (field 1). This value cannot be greater than the high value (field 6). The format for this field is determined by the DN/EU indicator (field 4). A DN/EU indicator set to DN indicates this value will be defined as a raw data number and contains a decimal integer. A DN/EU indicator set to EU indicates this value will be defined in engineering units and contains a floating-point number.

6. The prerequisite high value is specified with 15-characters defining the highest acceptable value, inclusive, of the prerequisite mnemonic to verify the condition for sending the associated command (field 1). This value cannot be less than the CEV low value (field 5). The format for this field is determined by the DN/EU indicator (field 4). A DN/EU indicator set to DN indicates this value will be defined as a raw data number and contains a decimal integer. A DN/EU indicator set to EU indicates this value will be defined in engineering units and contains a floating-point number.

5.2.7 Command Long Description Record

The Command Long Description Record provides a detailed description for a command parameter.

Record Length: 1628

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	5	5	Command parameter identifier
2	7	26	20	Command mnemonic
3	28	1627	1600	Command long description

Detailed Field Descriptions:

1. The command parameter identifier is specified as a five character decimal integer and uniquely represents the command parameter. This value must also be defined in the Command Parameter PDB.

2. The command mnemonic is specified with 20 ASCII characters representing the name of the command parameter. The format for this name is specified in Section 5.2.1. This name must also be defined in the Command Parameter PDB in combination with its command parameter id.

3 The command long description is specified with 1600 ASCII characters providing a detailed description of the command parameter.

5.2.8 Table Definition Record

The Table Definition Record defines areas of spacecraft or instrument memory. These areas of memory are used to store parameters and are used as a method of supplying commands. Each table is identified by a unique number and structure.

Record Length: 128

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	30	30	Table name
2	32	35	4	Table number
3	37	40	4	Table type
4	42	46	5	Maximum table size
5	48	127	80	Table descriptor

Detailed Field Descriptions:

1. The table name is specified with 30 ASCII characters identifying the name that is used to reference the table.
2. The table number is specified as a four character decimal integer representing a unique value identifying a memory table.
3. The table type is specified with four ASCII characters indicating the type of spacecraft memory table, where

   EPS = Power Subsystem

   FSW = Flight Software
4. The maximum table size is specified as a five character decimal integer (1-99999) indicating the size of the table in bytes.
5. The table descriptor is specified with 80 ASCII characters and provides textual information describing the table.

5.2.9 Table Field Definition Record

The Table Field Definition Record defines entries within the spacecraft or instrument table.

Record Length: 181

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	4	4	Table number
2	6	9	4	Field number
3	11	14	4	Value type
4	16	37	22	Default value
5	39	40	2	Value bit size
6	42	44	3	Data units
7	46	49	4	Scale factor
8	51	51	1	Range check flag
9	53	74	22	Low range value
10	76	97	22	High range value

Field	Start Byte	End Byte	Total Bytes	Contents
11	99	99	1	Value override flag
12	101	180	80	Field descriptor

Detailed Field Descriptions:

1. The table number is specified as a four character decimal integer representing a unique value identifying a memory table. This value must also be defined in the Table Definition PDB.

2. The field number is specified as a four character decimal integer representing a unique value which identifies the field within the table.

3. The value type is specified with four ASCII characters indicating the data type of the value in this field, where

   UI = unsigned integer (1-16 bits)

   ULI = unsigned long integer (1-32 bits)

   1750 = single precision floating point in MIL-STD-1750A format (32/48 bits)

4. The default value is specified with 22-characters defining a default for this field when no value has been user specified. The format for this field is determined by the value type.

5. The value bit size is specified as a two character decimal integer indicating the size of the value in bits.

6. The data units is specified with three ASCII characters and indicates the units of the field value.

7. The scale factor is specified as a four character decimal integer defining the factor to be applied to the word value within this field.

8. The range check flag is specified with one ASCII character indicating whether range checking is performed, where:

   Y = yes, perform range checking

   N = no, range checking not performed

9. The low range value is specified with 22-characters defining the low end of the range of values allowed for this field. The format for this field is determined by the value type.

10. The high range value is specified with 22-character defining the high end of the range of values allowed for this field.

11. The value override flag is specified with one ASCII character indicating whether the value may be overwritten with a new value during table generation, where:

Y = yes, value can be overwritten

N = no, value cannot be overwritten

12. The field descriptor is specified with 80 ASCII characters and provides textual information describing the field.

5.2.10 Memory Masking Definition Record

The Memory Masking Definition Record identifies an area of spacecraft or instrument memory which is ignored when comparing the dump and ground memory image.

Record Length: 41

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	30	30	Mask name
2	32	35	4	Start address of mask
3	37	40	4	Number of masked words

Detailed Field Descriptions:

1. The mask name is specified with 30 ASCU characters identifying the name that is used to reference the mask definition.

2. The start address of the mask field is specified as a four character hexadecimal value defining the physical address in memory where the mask begins. The address represent the location of a 16-bit data word.

3. The number of masked words is specified as a four character decimal integer and represents the number of words to be masked in the masked area beginning with the start address.

5.2.11 Memory Mask Group Definition Record

The Memory Mask Group Definition Record assigns a mask name to a group.

Field Length: 62

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	30	30	Group name
2	32	61	30	Mask name

1. The group name is specified with 30 ASCU characters identifying the name that is used to group different areas of memory.

2. The mask name is specified with 30 ASCU characters identifying the name that is used to reference the mask.

5.3 Activity Records

5.3.1 Activity Definition Record

The Activity Definition Record provides the attributes of a generic activity. Activities represent templates for user requests to change the mode/configuration of an instrument or a spacecraft subsystem. An activity is composed of ATC and ground script commands defined in the Activity Command Definition Record. Additionally, each of these commands may have subfields (parameters) associated with them as identified in the Activity Command Definition PDB.

PDB Source: FOT

Record Length: 422

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	5	5	Activity id
2	7	46	40	Activity name
3	48	87	40	Activity resource name
4	89	89	1	Criticality indicator
5	91	345	255	Description
6	347	356	10	Default scheduling information
7	358	421	64	Class name

Detailed Field Descriptions:

1. The activity id is specified as a 5 character decimal integer (0-32767) providing a numerical identification of the activity. This value is system generated.

2. The activity name is specified with 40 ASCII characters uniquely identifying an activity.

3. The activity resource name is specified with 40 ASCII characters uniquely identifying a resource providing an identification of the resource the activity can be scheduled upon.

4. The criticality indicator is specified as a decimal integer indicating whether or not the activity has a critical command in it, where:

   0 = no critical commands in the activity

   1 = critical commands exist in the activity

   This field is system generated.

5. The description is entered by a tool through a user that comments an activity.

6. The default scheduling information is system generated and it is a 10 character decimal integer providing identification for the scheduling information.

7. The class name field specifies whether or not there is a derived activity type. This value is system generated.

5.3.2 Activity Directive Definition Record

The Activity Directive Definition Record provides the attributes for a directive that exists in an activity.

PDB Source: FOT

Record Length: 127

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	5	5	Activity id
2	7	26	20	Directive name
3	28	91	64	Class name
4	93	102	10	Directive offset time
5	104	113	10	Directive offset time milliseconds
6	115	115	1	Directive relative to start
7	117	126	10	directive id

Detailed Field Descriptions:

1. The activity id is specified as a 5 character decimal (0-32767) integer providing a numerical identification of the activity. It is system generated and it is used for planning and scheduling internal reference only.

2. The directive name is specified with 20 ASCII characters representing the valid ECL directive name that belongs to this activity.

3 The class name field specifies whether or not this is a derived directive. This value is system generated.

4. The directive offset time is specified as a 10 character decimal integer (0-2147483647) providing the offset time from the activity when the directive is to start executing.

5. The directive offset time milliseconds is specified as a 10 character decimal integer (0-2147483647) providing the millisecond portion of the offset time from the activity when the directive is to start executing.

6. The directive relative to start is specified as a decimal integer indicating whether or not the directive offset time is referenced to the activity start time or the activity stop time. The valid values are :

   0 = The directive is relative to the stop time of the activity.

   1 = The directive is relative to the start time of the activity.

7. The directive id specifies the id of the row of a derived directive table. This value is used for planning and scheduling internal reference only and it is system generated.

5.3.3 Activity Complex ECL Directive Definition Record

The Activity Complex ECL Directive Definition Record provides the attributes for a complex ECL directive that exists in an activity.

PDB Source: FOT

Record Length: 267

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	10	10	Directive id
2	12	266	255	Complex directive

Detailed Field Descriptions:

1. The directive id is specified as a 10 character decimal integer (0-2147483647) providing planning and scheduling internal references. This number is system generated.
2. The complex directive is specified with 255 ASCII characters representing the complex directive that belongs to an activity.

5.3.4 Activity ECL Command Procedure Directive Definition Record

The Activity ECL Command Procedure Directive Definition Record provides the attributes for an ECL command procedure directive that exists in an activity.

PDB Source: FOT

Record Length: 32

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	10	10	Directive id
2	12	31	20	Command procedure name

Detailed Field Descriptions:

1. The directive id is specified as a 10 character decimal integer (0-2147483647) providing planning and scheduling internal references. This number is system generated.
2. The command procedure name is specified with 20 ASCII characters representing a valid command procedure name.

5.3.5 Activity ECL Comment Directive Definition Record

The Activity ECL Comment Directive Definition Record provides the attributes for an ECL comment directive that exists in an activity.

PDB Source: FOT

Record Length: 267

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	10	10	Directive id
2	12	266	255	Comment directive

Detailed Field Descriptions:

1. The directive id is specified as a 10 character decimal integer (0-2147483647) providing planning and scheduling internal references. This number is system generated.
2. The comment directive is specified with 255 ASCII characters representing the comment directive that belongs to an activity.

5.3.6 Activity Command Definition Record

The Activity Command Definition Record provides the attributes of an activity command.

PDB Source: FOT

Record Length: 312

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	10	10	Directive id
2	12	21	10	Command id
3	23	42	20	Mnemonic
4	44	298	255	Description
5	300	300	1	Criticality indicator
6	302	311	10	Subfield id

Detailed Field Descriptions:

1. The directive id is specified as a 10 character decimal integer (0-2147483647) providing planning and scheduling internal references. This number is system generated.
2. The command id is specified as a 10 character decimal integer (0-2147483647) providing the command with an id.
3. The Mnemonic is the same as the command mnemonic name in the command database. It is the name of the command mnemonic that is used in the activity.
4. The description is entered by the tool and it is a user description of the command.

5. The criticality indicator is specified as a decimal integer indicating whether or not the activity has a critical command in it, where:

   0 = no critical commands in the activity
   1 = critical commands exist in the activity
   This is system generated.

6. The subfield (parameter) id is specified as a 10 character decimal integer (0-2147483647) providing a row in the subfield table for this table to access. This number is system generated.

5.3.7 Activity Command Subfield Definition Record

The Activity Command Subfield Definition Record is used to map every subfield to its command.

PDB Source: FOT

Record Length: 120

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	10	10	Subfield id
2	12	31	20	Subfield name
3	33	37	5	Subfield number
4	39	43	5	Directive Number
5	45	108	64	Class name
6	110	119	10	Derived subfield id

Detailed Field Descriptions:

1. The subfield (parameter) id is specified as a 10 character decimal integer (0-2147483647) providing planning and scheduling internal references. This number is system generated.

2. The subfield name is specified with 20 ASCII characters representing the subfield (command parameter) associated with a command. The subfield identified by a mnemonic must be defined as a valid subfield in the Subfield Specification Record.

3. The subfield number is specified as a 5 character decimal integer (0-32767) identifying the subfield within a command. It is system generated.

4. The directive number is specified as a 5 character decimal integer (0-32767) identifying the directive the parameter belongs to. It is system generated.

5. The class name field specifies whether or not there is a derived subfield type. This value is system generated.

6. The derived subfield id specifies a row in the derived subfield type.

5.3.8 Activity Default Command Subfield Definition Record

The Activity Default Command Subfield Definition Record is used to provide more detail on the command subfield.

PDB Source: FOT

Record Length: 13

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	10	10	Derived subfield id
2	12	12	1	modifiable

Detailed Field Descriptions:

1. The derived subfield (parameter) id is specified as a 10 character decimal integer (0-2147483647) providing planning and scheduling internal references. This number is system generated.
2. The modifiable flag is specified as a decimal integer indicating whether or not the subfield is modifiable, where:

   0 = it is not modifiable

   1 = it is a modifiable subfield

5.3.9 Activity Integer Subfield Definition Record

The Activity Integer Subfield Definition Record is used to define integer subfield values.

PDB Source: FOT

Record Length: 44

Record Format

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	10	10	Derived subfield id
2	12	21	10	Low value
3	23	32	10	High value
4	34	43	10	Value

Detailed Field Descriptions:

1. The derived subfield (parameter) id is specified as a 10 character decimal integer (0-2147483647) providing planning and scheduling internal references. This number is system generated.

2. The low value is specified as a 10 character decimal integer (0-2147483647) holding the lowest possible value for this subfield.

3. The high value is specified as a 10 character decimal integer (0-2147483647) holding the highest possible value for this subfield.

4. The value is specified as a 10 character decimal integer (0-2147483647) holding the default value for this subfield.

5.3.10 Activity Float Subfield Definition Record

The Activity Float Subfield Definition Record is used to define float subfield values.

PDB Source: FOT

Record Length: 77

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	10	10	Derived subfield id
2	12	32	21	Low value
3	34	54	21	High value
4	56	76	21	Value

Detailed Field Descriptions:

1. The derived subfield (parameter) id is specified as a 10 character decimal integer (0-2147483647) providing planning and scheduling internal references. This number is system generated.

2. The low value is specified as 21 characters, where one of the characters is a decimal point. This field holds the lowest possible value for this subfield.

3. The high value is specified as 21 characters, where one of the characters is a decimal point. This field holds the highest possible value for this subfield.

4. The value is specified as 21 characters, where one of the characters is a decimal point. This field holds the default value for this subfield.

5.3.11 Activity Discrete Subfield Definition Record

The Activity Discrete Subfield Definition Record is used to define discrete subfield values.

PDB Source: FOT

Record Length: 32

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	10	10	Derived subfield id
2	12	31	20	Value

Detailed Field Descriptions:

1. The derived subfield (parameter) id is specified as a 10 character decimal integer (0-2147483647) providing planning and scheduling internal references. This number is system generated.
2. The value is specified with 20 ASCII characters representing the discrete parameter value.

5.3.12 Activity Discrete Subfield Valid Values Definition Record

The Activity Discrete Subfield valid values Definition Record is used to define discrete subfield valid values.

PDB Source: FOT

Record Length: 32

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	10	10	Derived subfield id
2	12	31	20	Valid value

Detailed Field Descriptions:

1. The derived subfield (parameter) id is specified as a 10 character decimal integer (0-2147483647) providing planning and scheduling internal references. This number is system generated.
2. The valid value is specified with 20 ASCII characters representing the valid discrete parameter values.

5.3.13 Activity Function Subfield Definition Record

The Activity Function Subfield Definition Record is used to keep a function name subfield value.

PDB Source: FOT

Record Length: 32

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	10	10	Derived subfield id
2	12	31	20	Function Name

Detailed Field Descriptions:

1. The derived subfield (parameter) id is specified as a 10 character decimal integer (0-2147483647) providing planning and scheduling internal references. This number is system generated.
2. The function name is specified with 20 ASCII characters representing the function name. Planning and scheduling will provide the function names for the user.

5.3.14 Activity Command Procedure Definition Record

The Activity Command Procedure Definition Record associates command procedures with an activity.

PDB Source: FOT

Record Length: 48

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	10	10	Directive id
2	22	41	20	Command procedure name

Detailed Field Descriptions:

1. The directive id is specified as a 10 character decimal integer (0-2147483647) providing planning and scheduling internal references. This number is system generated.
2. The command procedure name is specified with 20 ASCII characters representing the command procedure associated with a directive.

5.3.15 Complex Activity Child Reference Record

The Complex Activity Child Reference Record gives information on scheduling an activity within another activity.

PDB Source: FOT

Record Length: 36

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	5	5	Activity id
2	7	11	5	Reference act id
3	13	22	10	Reference relative offset time
4	24	33	10	Reference relative offset time milliseconds
5	35	35	1	Reference relative to start

Detailed Field Descriptions:

1. The activity id is specified as a 5 character decimal integer (0-32767) providing a numerical identification of the activity. This value is system generated.
2. The reference activity id is specified as a 5 character decimal integer (0-32767) providing a numerical identification of the parent complex activity. This value is system generated.
3. The offset time is specified as a 10 character decimal integer (0-2147483647) in seconds providing the offset time from the complex activity when the activity is to start executing.
4. The millisecond offset time is specified as a 10 character decimal integer (0-2147483647) providing the millisecond portion of the offset time from the complex activity when the activity is to start executing.
5. The reference relative to start is specified as a decimal integer indicating whether or not the offset time is referenced to the complex activity start time or the complex activity stop time, where:

   0 = No, this is referenced to the stop time.

   1 = Yes, this is referenced to the start time.

5.3.16 Activity Mode Transition Definition Record

The Activity Mode Transition Definition Record provides information on the valid mode transitions within an activity.

PDB Source: FOT

Record Length: 102

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	5	5	Activity id
2	7	46	40	Mode resource name
3	48	77	30	New mode
4	79	88	10	Mode offset time
5	90	99	10	Mode offset time milliseconds
6	101	101	1	Mode relative to start

Detailed Field Descriptions:

1. The activity id is specified as a 5 character decimal integer (0-32767) providing a numerical identification of the activity. This value is system generated.
2. The mode resource name is represented by 40 ASCII characters and it identifies the resource that the activity will be scheduled against.
3. The new mode is the mode that the activity is going to transition into. It is represented by 30 ASCII characters and the format is in the activity mode definition record.
4. The offset time is specified as a 10 character decimal integer (0-2147483647) in seconds providing the offset time from the activity when the mode change is to occur.
5. The millisecond offset time is specified as a 10 character decimal integer (0-2147483647) providing the millisecond portion of the offset time from the activity when the mode change is to occur.
6. The mode relative to start is specified as a decimal integer indicating whether or not the offset time is referenced to the activity start time or the activity stop time, where:

   0 = No, this is referenced to the stop time.

   1 = Yes, this is referenced to the start time.

5.3.17 Activity Mode Definition Record

The Activity Mode Definition Record provides information on the power, data rate, resource that the mode can be scheduled on.

PDB Source: FOT

Record Length: 81

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	5	5	Resource id
2	7	36	30	Mode name
3	38	58	21	Power
4	60	80	21	Data rate

Detailed Field Descriptions:

1. The resource id is specified as a 5 character decimal integer (0-32767) providing a numerical identification of the resource.
2. The mode name is represented by 30 ASCII characters.
3. The power is specified as 21 characters, where one of the characters is a decimal point. This field holds the amount of power in megawatts consumed by this mode.
4. The data rate is specified as 21 characters, where one of the characters is a decimal point. This field holds the data rate in megabits per second that fills up a solid state recorder that is used by the mode.

5.3.18 Activity Resource Definition Record

The Resource Definition Record provides information on resources for planning and scheduling.

PDB Source: FOT

Record Length: 116

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	5	5	Resource id
2	7	46	40	Resource name
3	48	111	64	Class name
4	113	115	3	Subsystem

Detailed Field Descriptions:

1. The resource id is specified as a 5 character decimal integer (0-32767) providing a numerical identification of the resource. This value is system generated.
2. The resource name is represented by 40 ASCII characters and it defines a resource.
3. The class name field specifies whether or not there is a derived resource. This value is system generated.
4. The subsystem is a three character representation of the different subsystems on the spacecraft.

5.3.19 Activity Resource Command Definition Record

The Activity Resource Command Definition Record provides information on resource commands for planning and scheduling.

PDB Source: FOT

Record Length: 17

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	5	5	Resource id
2	7	16	10	Discrete Rate

Detailed Field Descriptions:

1. The resource id is specified as a 5 character decimal integer (0-32767) providing a numerical identification of the resource. This value is system generated.
2. The discrete rate is specified as a 10 character decimal integer (0-2147483647) providing the number of commands per second that are scheduled at one time.

5.3.20 Activity Resource Power Definition Record

The Activity Resource Power Definition Record provides information on resource commands for planning and scheduling.

PDB Source: FOT

Record Length: 28

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	5	5	Resource id
2	7	27	21	Max watts

Detailed Field Descriptions:

1. The resource id is specified as a 5 character decimal integer (0-32767) providing a numerical identification of the resource. This value is system generated.
2. The max watts is specified as 21 characters, where one of the characters is a decimal point. This field holds the maximum power value for this resource.

5.3.21 Activity Resource Buffer Definition Record

The Activity Resource Buffer Definition Record provides information on resource commands for planning and scheduling.

PDB Source: FOT

Record Length: 50

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	5	5	Resource id
2	7	27	21	Max size
3	29	49	21	Max rate

Detailed Field Descriptions:

1. The resource id is specified as a 5 character decimal integer (0-32767) providing a numerical identification of the resource. This value is system generated.
2. The max size is specified as 21 characters, where one of the characters is a decimal point. This field holds in megabits the maximum size for the solid state recorder buffer for this resource.
3. The max rate is specified as 21 characters, where one of the characters is a decimal point. This field holds in megabits per second the maximum rate for the solid state recorder buffer for this resource.

5.3.22 Activity Resource Hierarchy Definition Record

The Activity Resource Hierarchy Definition Record provides a resource parent-child relationship.

PDB Source: FOT

Record Length: 82

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	40	40	Parent resource name
2	42	81	40	Child resource name

Detailed Field Descriptions:

1. The parent resource name is represented by 40 ASCII characters and it defines a resource.
2. The child resource name is represented by 40 ASCII characters and it defines a resource.

5.3.23 Activity Scheduling Resource Hierarchy Definition Record

The Activity Scheduling Resource Hierarchy Definition Record provides a scheduling resource parent-child relationship.

PDB Source: FOT

Record Length: 82

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	40	40	Parent resource name
2	42	81	40	Child resource name

Detailed Field Descriptions:

1. The parent resource name is represented by 40 ASCII characters and it defines a resource.
2. The child resource name is represented by 40 ASCII characters and it defines a resource.

5.3.24 Activity Scheduling Resource Definition Record

The Scheduling Resource Definition Record provides information on scheduling resources for planning and scheduling.

PDB Source: FOT

Record Length: 106

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	40	40	Resource name
2	42	105	64	Class name

Detailed Field Descriptions:

1. The resource name is represented by 40 ASCII characters and it defines a resource. This value is set up by the planning and scheduling developers.
2. The class name field specifies whether or not there is a derived resource. This value is system generated.

5.4 Constraint Records

5.4.1 Command Constraint Records

5.4.1.1 Bit Rule Definition Record

The Bit Rule Definition Record provides the criteria to use when performing the constraint check that ensures the value of the trigger command's subfield bits satisfy the condition of equal to or not equal to the specified bit value. A separate rule must be defined for each trigger command subfield bit being compared.

PDB Source: FOT

Record Length: 58

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	4	4	Constraint identifier
2	6	25	20	Trigger command mnemonic
3	27	46	20	Subfield name
4	48	50	3	Bit location
5	52	52	1	Bit value
6	54	55	2	Relational operator
7	57	57	1	Hard/Soft flag

Detailed Field Descriptions:

1. The constraint identifier is specified with a four character decimal integer uniquely representing the command constraint. This value is system generated.

2. The trigger command mnemonic is specified with 20 ASCII characters representing the command parameter with a Bit Rule constraint. This mnemonic must be specified as a valid command parameter in the Command Description PDB. The format for this field is defined in Section 5.2.1.

3. The subfield name is specified with 20 ASCII characters representing the subfield associated with the command parameter (field 2). This value must be specified in the Command Variable Data Word Specification PDB in association with the command parameter (field 2).

4. The bit location is specified as a three character decimal integer (1-528) indicating the offset of the bit with respect to the start of the command data structure.

5. The bit value is specified as a one character decimal integer (0-1) representing the value of the bit to be compared with.

6. The relational operator is specified with two ASCII characters representing the operator used in conjunction with the bit value to satisfy the constraint, where:

   EQ = equal to

   NE = not equal to

7. The hard/soft flag is specified with one ASCII character representing the severity of the constraint, where:

   H = hard constraint; indicates this type of constraint would result in an error

   S = soft constraint; indicates this type of constraint would result in a warning message

5.4.1.2 Comment Rule Definition Record

The Comment Rule Definition Record associates a specific warning message with a command. When the command, referred to as the trigger command, is encountered, the defined message is output to the user. The Comment Rule can specify constraint criteria at subfield and subfield bit level for the trigger command, therefore, the constraint ID may also be specified in the Subfield Constraint Definition PDB and/or the Subfield Bit Constraint Definition PDB.

PDB Source: FOT

Record Length: 107

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	4	4	Constraint identifier
2	6	25	20	Trigger command mnemonic
3	27	106	80	Output message

Detailed Field Descriptions:

1. The constraint identifier is specified with a four character decimal integer uniquely representing the command constraint. This value is system generated.

2. The trigger command mnemonic is specified with 20 ASCII characters representing the command parameter with a Comment Rule constraint. This mnemonic must be specified as a valid command parameter in the Command Description PDB. The format for this field is defined in Section 5.2.1.

3. The output message is specified with 80 ASCII characters representing the text string to be associated with the command parameter.

5.4.1.3 No Exist Rule Definition Record

The No Exist Rule Definition Record identifies commands that must not occur in the same command list, i.e., when the trigger command is found in the command list, the excluder command must not appear. The No Exist Rule does not specify constraints at the subfield or subfield bit level for both the trigger and excluder commands.

PDB Source: FOT

Record Length: 48

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	4	4	Constraint identifier
2	6	25	20	Trigger command mnemonic
3	27	46	20	Excluder command mnemonic
4	47	47	1	Hard/Soft flag

Detailed Field Descriptions:

1. The constraint identifier is specified with a four character decimal integer uniquely representing the command constraint. This value is system generated.

2. The trigger command mnemonic is specified with 20 ASCII characters representing the command parameter with a No Exist Rule constraint. This mnemonic must be specified as a valid command parameter in the Command Description PDB. The format for this field is defined in Section 5.2.1.

3. The excluder command mnemonic is specified with 20 ASCII characters representing the command parameter that must not occur when the trigger command exists. This mnemonic must be specified as a valid command parameter in the Command Description PDB. The format for this field is defined in Section 5.2.1.

4. The hard/soft flag is specified with one ASCII character representing the severity of the constraint, where:

   H = hard constraint; indicates this type of constraint would result in an error

   S = soft constraint; indicates this type of constraint would result in a warning message

5.4.1.4 Offset Rule Definition Record

The Offset Rule Definition Record provides the criteria to use when performing one of the four Offset Rules. Offset rules include No Commands After Rule, No Commands Before Rule, Repeat After Rule and No Remote Terminal (RT) Command Rule. The Offset Rules do not specify constraints at the subfield or subfield bit level for the trigger command.

PDB Source: FOT

Record Length: 47

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	4	4	Constraint identifier
2	6	25	20	Trigger command mnemonic
3	27	27	1	Offset rule type
4	29	34	5	Delta time

Field	Start Byte	End Byte	Total Bytes	Contents
5	35	35	1	Hard/Soft flag
6	37	46	10	Maximum repeats

Detailed Field Descriptions:

1. The constraint identifier is specified with a four character decimal integer uniquely representing the command constraint. This value is system generated.

2. The trigger command mnemonic is specified with 20 ASCII characters representing the command parameter with an Offset Rule constraint. This mnemonic must be specified as a valid command parameter in the Command Description PDB. The format for this field is defined in Section 5.2.1.

3. The offset rule type is specified with a one character decimal integer (1-4) indicating the type offset rule being defined, where:

   1 = No Commands After Rule - when the trigger command occurs then there will be no commanding afterwards for at least the delta time defined

   2 = No Commands Before Rule - when the trigger command occurs then there will be no commanding before for at least the delta time defined

   3 = Repeat After Rule - when the trigger command occurs then the trigger command can not be repeated before the delta time defined

   4 = No RT Command Rule - when the trigger command occurs, then no commands can be sent to the same RT for at least the delta time defined

4. The delta time is specified with five ASCII characters representing the time in seconds and milliseconds in which the rule must adhere to. The format for this time value is mm:ss, where:

   mm = minutes

   ss = seconds

5. The hard/soft flag is specified with one ASCII character representing the severity of the constraint, where:

   H = hard constraint; indicates this type of constraint would result in an error

   S = soft constraint; indicates this type of constraint would result in a warning message

6. The maximum repeats is specified with a 10-character decimal integer indicating the maximum number of repeats allowed with the delta time. This value is only used with the Repeat After Rule. No more than one command per second is allowed.

5.4.1.5 Prerule Definition Record

The Prerule Definition Record provides the criteria to use when performing the constraint check which ensures a command, referred to as the satisfier, occurs prior to the trigger command within a specified time range. Additionally, another command, know as the excluder, may be defined not to occur between the satisfier and trigger commands in the same constraint rule. The Prerule can specify constraint criteria at the subfield and/or subfield bit level for the trigger, satisfier and excluder commands, therefore the constraint ID may also be specified in the Subfield Constraint Definition PDB and/or the Subfield Bit Constraint Definition PDB.

PDB Source: FOT

Record Length: 82

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	4	4	Constraint identifier
2	6	25	20	Trigger command mnemonic
3	27	46	20	Satisfier command mnemonic
4	27	31	5	Minimum time
5	33	37	5	Maximum time
6	39	58	20	Excluder command mnemonic
7	60	60	1	Hard/Soft flag

Detailed Field Descriptions:

1. The constraint identifier is specified with a four character decimal integer uniquely representing the command constraint.

2. The trigger command mnemonic is specified with 20 ASCII characters representing the command parameter with a Prerule constraint. This mnemonic must be specified with a valid command parameter in the Command Description PDB. The format for this field is defined in Section 5.2.1.

3. The satisfier command mnemonic is specified with 20 ASCU characters representing the command parameter that satisfies the constraint rule. This mnemonic must be specified with a valid command parameter in the Command Description PDB. The format for this field is defined in Section 5.2.1.

4. The minimum time is specified with five ASCII characters indicating the minimum time a satisfier command must occur prior to the trigger command. The format for their time value is mm:ss, where:

   mm = minutes

   ss = seconds

5. The maximum time is specified with five ASCII characters indicating the maximum time the satisfier command must occur prior to the trigger command. The format for this time is defined in field 3. This value must be greater than or equal to the minimum time (field 3).

6. The excluder command mnemonic is specified with 20 ASCII characters representing the command parameter that must not occur between the trigger and satisfier commands. This mnemonic must be specified with a valid command parameter in the Command Description PDB. The format for this field is defined in Section 5.2.1.

7. The hard/soft flag is specified with one ASCII character representing the severity of the constraint, where:

   H = hard constraint; indicates this type of constraint would result in an error

   S = soft constraint; indicates this type of constraint would result in a warning message

5.4.1.6 Postrule Definition Record

The Postrule Definition Record provides the criteria to use when performing the constraint check which ensures that a satisfier command will occur within a specified time range after the trigger command is issued. The Postrule can specify constraint criteria at the subfield and/or subfield bit level for the trigger and satisfier commands, therefore the constraint ID may also be specified in the Subfield Constraint Definition PDB and/or the Subfield Bit Constraint Definition PDB.

PDB Source: FOT

Record Length: 61

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	4	4	Constraint identifier
2	6	25	20	Trigger command mnemonic
3	27	46	20	Satisfier command mnemonic
4	48	52	5	Minimum time
5	54	58	5	Maximum time
6	60	60	1	Hard/Soft flag

Detailed Field Descriptions:

1. The constraint identifier is specified with a four character decimal integer uniquely representing the command constraint.

2. The command mnemonic is specified with 20 ASCII characters representing the command parameter with a Postrule constraint. This mnemonic must be specified with a valid command parameter in the Command Description PDB. The format for this field is defined in Section 5.2.1.

3. The satisfier command mnemonic is specified with 20 ASCU characters representing the command parameter that satisfies the constraint rule. This mnemonic must be specified with a valid command parameter in the Command Description PDB. The format for this field is defined in Section 5.2.1.

4. The minimum time is specified with five ASCII characters indicating the minimum time a satisfier command must occur prior to the trigger command. The format for their time value is mm:ss, where:

   mm = minutes

   ss = seconds

5. The maximum time is specified with five ASCII characters indicating the maximum time the satisfier command must occur prior to the trigger command. The format for this time is defined in field 3. This value must be greater than or equal to the minimum time (field 3).

6. The hard/soft flag is specified with one ASCII character representing the severity of the constraint, where:

   H = hard constraint; indicates this type of constraint would result in an error

   S = soft constraint; indicates this type of constraint would result in a warning message

5.4.1.7 Scalar Rule Definition Record

The Scalar Rule Definition Record provides the criteria to use when performing the constraint check which ensures the value of the trigger command's subfield satisfies the specified data value in association with its relational operator. A separate rule must be defined for each trigger command subfield to be compared.

PDB Source: FOT

Record Length: 64

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	4	4	Constraint identifier
2	6	25	20	Trigger command mnemonic
3	27	46	20	Subfield name
4	47	58	12	Scalar data value
5	60	61	2	Relational operator
6	63	63	1	Hard/Soft flag

Detailed Field Descriptions:

1. The constraint identifier is specified with a four character decimal integer uniquely representing the command constraint. This value is system generated.

2. The trigger command mnemonic is specified with 20 ASCII characters representing the command parameter with a Scalar Rule constraint. This mnemonic must be specified as a valid command parameter in the Command Description PDB. The format for this field is defined in Section 5.2.1.

3. The subfield name is specified with 20 ASCII characters representing a subfield associated with the command parameter (field 2). This name must be specified in the Command Variable Data Word Specification PDB in association with its command parameter (field 2).

4. The scalar data value is specified as a 12 character floating point value indicating the criteria for verifying the constraint.

5. The relational operator is specified with two ASCII characters indicating how the value of the subfield is compared with the scalar data value (field 4), where

   LT = less than

   LE = less than or equal to

   GT = greater than

   GE = greater than or equal to

   EQ = equal to

   NE = not equal to

6. The hard/soft flag is specified with one ASCII character representing the severity of the constraint, where:

   H = hard constraint; indicates this type of constraint would result in an error

   S = soft constraint; indicates this type of constraint would result in a warning message

5.4.1.8 Subfield Constraint Definition Record

The Subfield Constraint Definition Record provides the criteria for the command subfield in association with their constraint rule. Triggers, satisfiers, and excluder may have subfield criteria defined in a constraint rule.

PDB Source: FOT

Record Length: 60

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	4	4	Constraint identifier
2	6	25	20	Command mnemonic
3	27	46	20	Subfield name
4	48	59	12	Data value

Detailed Field Descriptions:

1. The constraint identifier is specified with a four character decimal integer uniquely representing the command constraint. This value must also be defined in the Comment Rule Definition PDB, the Prerule Definition PDB, or the Postrule Definition PDB.

2. The command mnemonic is specified with 20 ASCII characters representing the command parameter associated with the constraint rule. This mnemonic must be defined in the Comment Rule Definition PDB, the Prerule Definition PDB or the Postrule Definition PDB as a trigger, excluder or satisfier command.

3. The subfield name is specified with 20 ASCII characters representing the subfield associated with the command parameter (field 2) for the constraint rule. This value must be specified in the Command Variable Data Word Specification PDB in association with the command mnemonic (field 2).

4. The data value is specified as a 12 character floating point number indicating the value of the subfield to be compared in the constraint check.

5.4.1.9 Subfield Bit Constraint Definition Record

The Subfield Bit Constraint Definition Record provides the criteria for the command subfield bits in association with the constraint rule. The Comment Rule Definition PDB, the Prerule Definition PDB or the Postrule Definition PDB may specify constraint criteria at the command subfield bit level.

PDB Source: FOT

Record Length: 53

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	4	4	Constraint identifier
2	6	25	20	Command mnemonic
3	27	46	20	Subfield name
4	48	50	3	Bit location
5	52	52	1	Bit value

Detailed Field Descriptions:

1. The constraint identifier is specified with a four character decimal integer uniquely representing the command constraint. This value must be specified in the Comment Rule Definition PDB, the Prerule Definition PDB or the Postrule Definition PDB.

2. The command mnemonic is specified with 20 ASCII characters representing the command parameter associated with the constraint rule. This mnemonic must be defined in the Comment Rule Definition PDB, the Prerule Definition PDB, or the Postrule Definition PDB as a trigger, excluder or satisfier command.

3. The subfield name is specified with 20 ASCII characters representing the subfield associated with the command parameter (field 2) for the constraint rule. This value must be specified in the Command Variable Data Word Specification PDB.
4. The bit location is specified as a three character decimal integer (1-528) indicating the offset of the bit from the start of the command data structure.
5. The bit value is specified as a one character decimal integer (0-1) representing the value of the bit to be compared with.

5.4.2 Activity Constraint Records

5.4.2.1 Operational Mode Specification Record

The operational mode identifies an operational state associated with an instrument, spacecraft subsystem or EOC ground system component.

PDB Source: FOT

Record Length: 72

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	40	40	Resource name
2	42	71	30	Mode name

Detailed Field Descriptions:

1. The resource name is specified with 40 ASCII characters and identifies the valid instrument, spacecraft subsystem or ground system component with which the mode is associated.
2. The mode name is specified with 30 ASCII characters identifying an operational state for an instrument, spacecraft subsystem or ground system component.

5.4.2.2 Operational Mode Transition Specification Record

The Operational Mode Transition Specification Record indicates the valid operational state transitions for instruments, spacecraft subsystems or ground system components as defined at the mode-level. All valid mode transitions are defined using a rule-based syntax.

PDB Source: FOT

Record Length: 103

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	40	40	Resource name
2	42	71	30	Mode name
3	73	102	30	Transition to mode name

Detailed Field Descriptions:

1. The resource name is specified with 40 ASCII characters and identifies the valid instrument, spacecraft subsystem or ground system component with which the mode is associated.
2. The mode name is specified with 30 ASCII characters identifying an operational state for an instrument, spacecraft subsystem or ground system component.
3. The transition to mode name is specified with 30 ASCII characters identifying an operational state for an instrument, spacecraft subsystem or ground system component that it is transitioning to.

5.4.2.3 Event Specification Record

The Event Specification record indicates the events that are valid so that other tables may do their validations

PDB Source: FOT

Record Length: 21

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	20	20	Event name

Detailed Field Descriptions:

1. The event name is specified with 20 ASCII characters identifying the events.

5.4.2.4 Activity Constraint Specification Record

The Activity Constraint Specification Record indicates the activity-level constraints that are defined for instruments, spacecraft subsystems and ground system components. The activity constraint is defined using a rule-based syntax.

PDB Source: FOT

Record Length: 178

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	40	40	LHS resource
2	42	81	40	RHS resource
3	83	122	40	RHS item
4	124	163	40	LHS item
5	165	166	2	Constraint type
6	168	177	10	Constraint offset

Detailed Field Descriptions:

1. The left hand side resource name is specified with 40 ASCII characters and identifies the valid instrument, spacecraft subsystem or ground system component.
2. The right hand side resource name is specified with 40 ASCII characters and identifies the valid instrument, spacecraft subsystem or ground system component.
3. The right hand side item is either an activity name, event name, or a mode name.
4. The left hand side item is either an activity name, event name, or a mode name.
5. The constraint type is specified by a 2 character field. The valid characters are:
   - < before
   - > after
   - : during
   - !: not during
6. The constraint offset is specified by a 10 character decimal digit (0-2,147,483,647) in seconds.

5.4.2.5 Consumable Constraint Specification Record

Consumables represent a modeling parameter that can be consumed and replenished. The two types of consumables on AM-1 modeled by P&S are:

1) power consumed by the power subsystem
2) data volume stored in the solid-state recorder buffers

Constraints are violated when the consumable exceeds the maximum threshold. The consumable constraint record indicates the maximum values.

PDB Source: FOT

Record Length: 52

Record Format:

Field	Start Byte	End Byte	Total Bytes	Contents
1	1	40	40	Resource name
2	42	51	10	Maximum consumable value

Detailed Field Descriptions:

1. The resource name is specified with 40 ASCII characters identifying the spacecraft subsystem with which the consumable constraint is associated. These names are restricted to resources that model consumables.

2. The maximum consumable value indicates the maximum threshold, where exceeding will cause a constraint violation to occur. For the power subsystem (EPS), the value is in units of Watts, indicating the maximum amount of power that can be consumed by the spacecraft. For the solid-state recorder buffers, the value is specified in units of MBits, indicating the maximum data volume that can be stored in each of the solid-state recorder buffers.

Abbreviations and Acronyms

APID	Application Identifier
ASCII	American Standard Code for Information Interchange
ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer
BDU	Bus Data Unit
C&DHS	Command & Data Handling System
CCB	Configuration Control Board
CCR	Configuration Change Request
CCSDS	Consultative Committee for Space Data Systems
CDR	Critical Design Review
CDRL	Contract Data Requirement List
CERES	Clouds and the Earth's Radiant Energy System
COMMS	Communications
CTIU	Command/Telemetry Interface Unit
DBA	Data Base Administrator
DCN	Document Change Notice
DFCD	Data Format Control Document
DID	Data Item Description
ECS	EOSDIS Core System
EDOS	EOS Data Operations System
EDU	EDOS Data Unit
EOC	EOS Operations Center
EOS	Earth Observing System
EOSDIS	Earth Observing System Data & Information System
ESDIS	Earth Science Data and Information System
EU	engineering unit
FOS	Flight Operations Segment

FOT	Flight Operations Team
GN&CS	Guidance, Navigation and Control System
GSFC	Goddard Space Flight Center
I&T	integration & test
ICD	Interface Control Document
IRD	Interface Requirement Document
IST	Instrument Support Terminal
NASA	National Aeronautics and Space Administration
ODB	Operational Data Base
PDB	Project Data Base
RT	remote terminal
SCC	Spacecraft Control Computer
SDVF	Software Development and Validation Facility
SOW	Statement of Work
TBC	To Be Confirmed
TBD	To Be Determined
TBR	To Be Resolved
TBS	To Be Supplied